PRINTING

by Harold Curwen

illustrated by Jack Brough

PUFFIN PICTURE BOOKS

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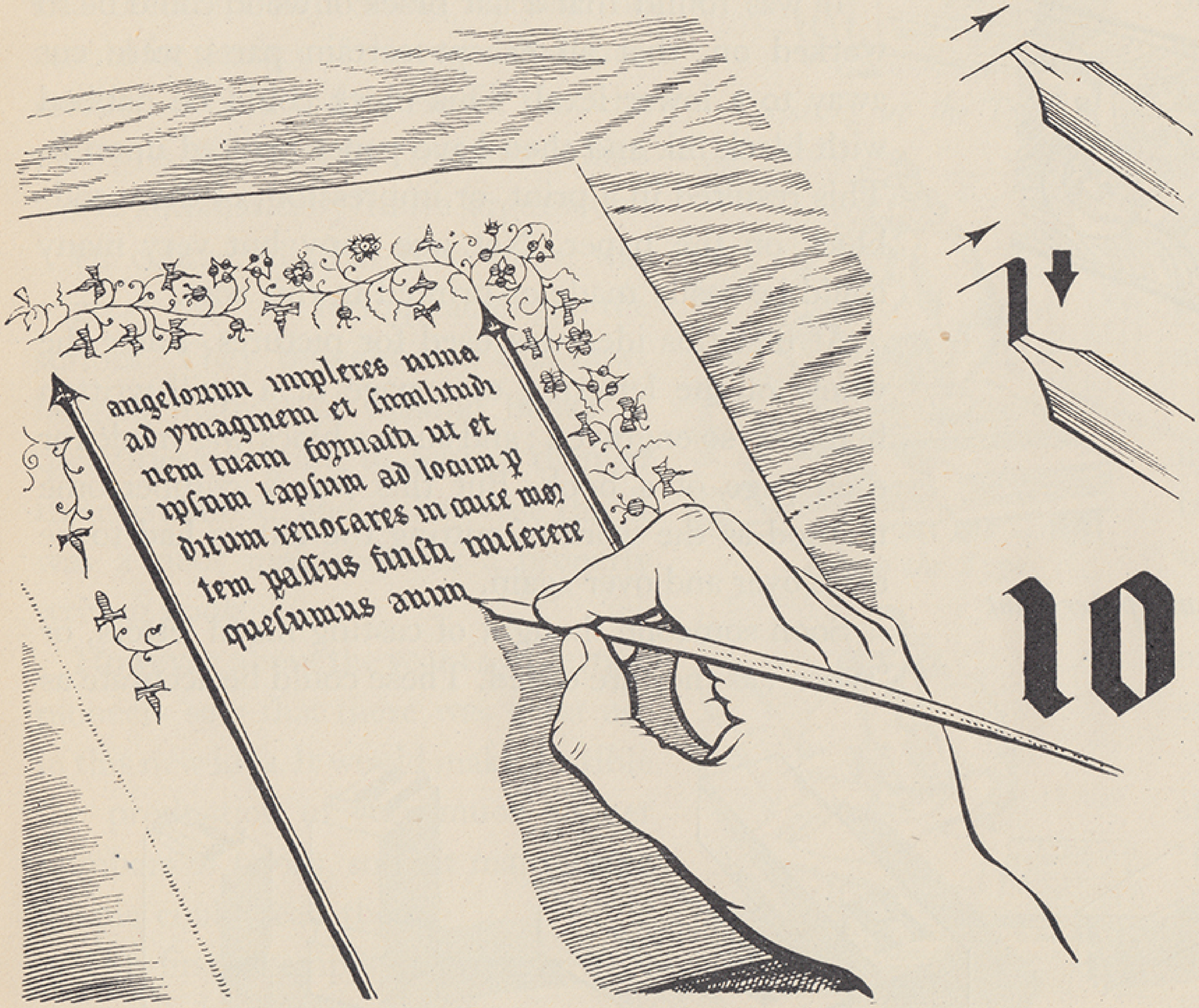
PRINTING GREW FROM WRITING

THIS book is produced by 'Letterpress' printing in five colours. There are many other processes of printing, and we are going to tell you, and show you by drawings, something about them.



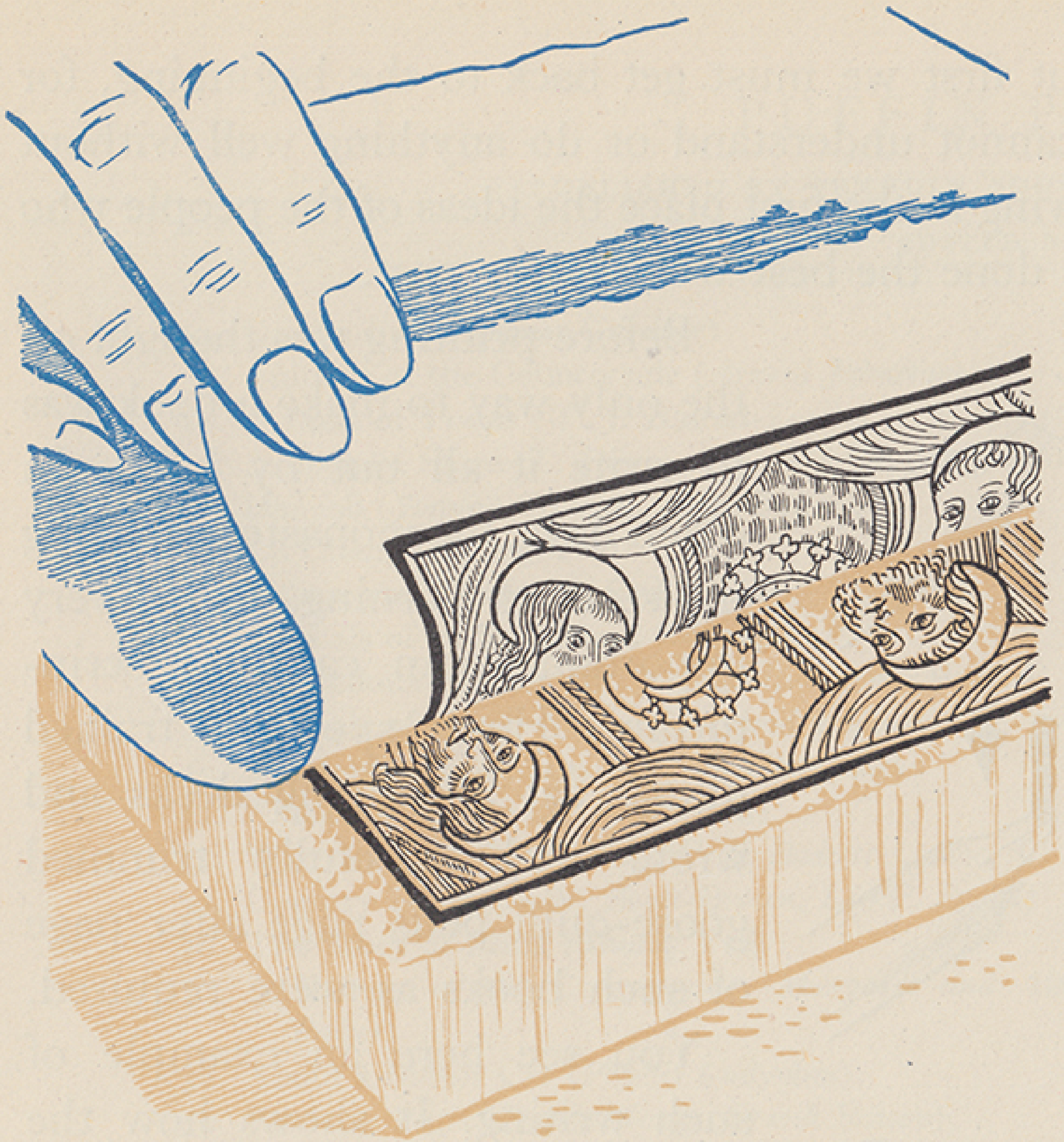
The broad pen formed the letter shapes

But first we must get back to the beginning, for we cannot understand or do anything well without knowing in the first place the ideas of the people who have done the best work in the past.

Before printing was thought of, the only way to make a book was to write it all out by hand. In olden days, the monasteries, being the seats of learning, had a very important room called a scriptorium. Here, specially trained monks sat at sloping desks and wrote with carefully trimmed goose-quill pens page after page of such books as were required.

You see here an example of such writing. It shows how the letters were formed by the chisel-like edge of the pen, into thick and thin strokes.

Actually the decoration in such a piece of work as that shown here would be done after the scribe had finished his part, and by another hand. But it is shown here complete for its interest.



Woodblock and paper print

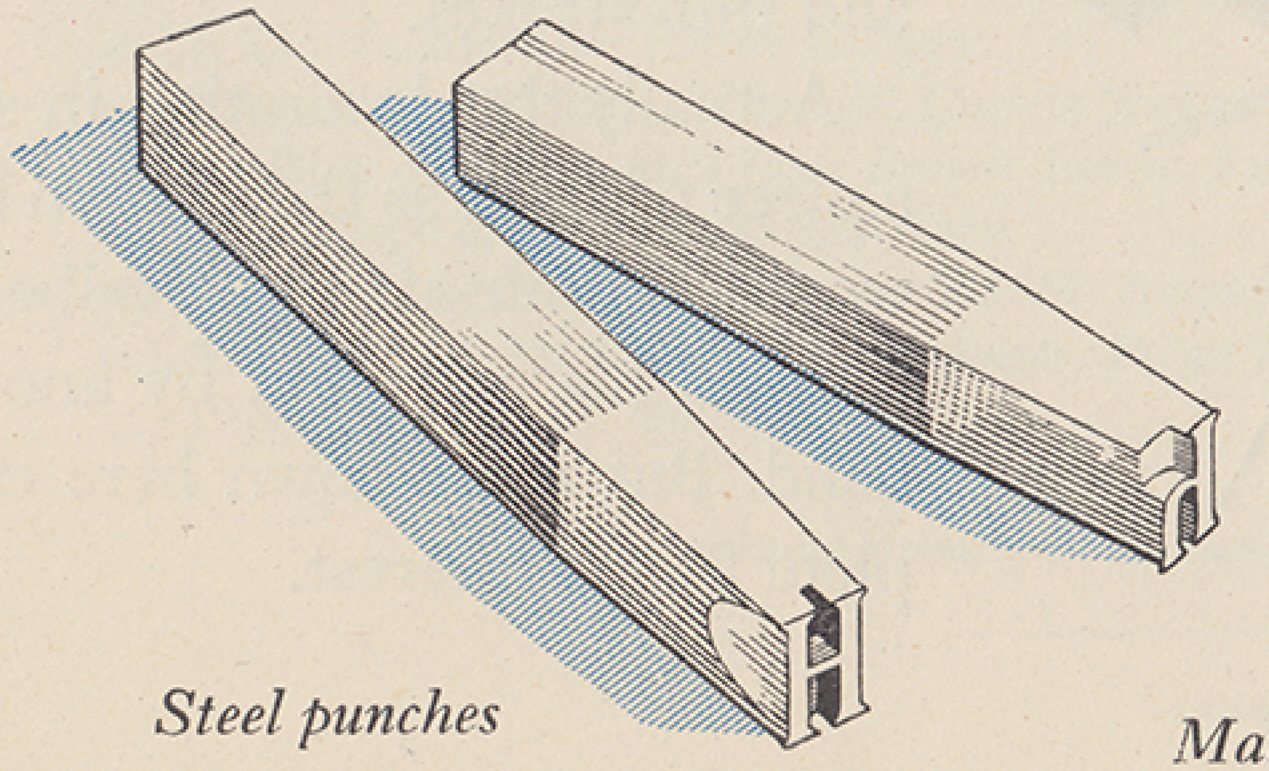
EARLY PRINTING FROM WOODBLOCKS AND TYPE

The invention of printing made it possible to produce many copies much more quickly, as you shall see.

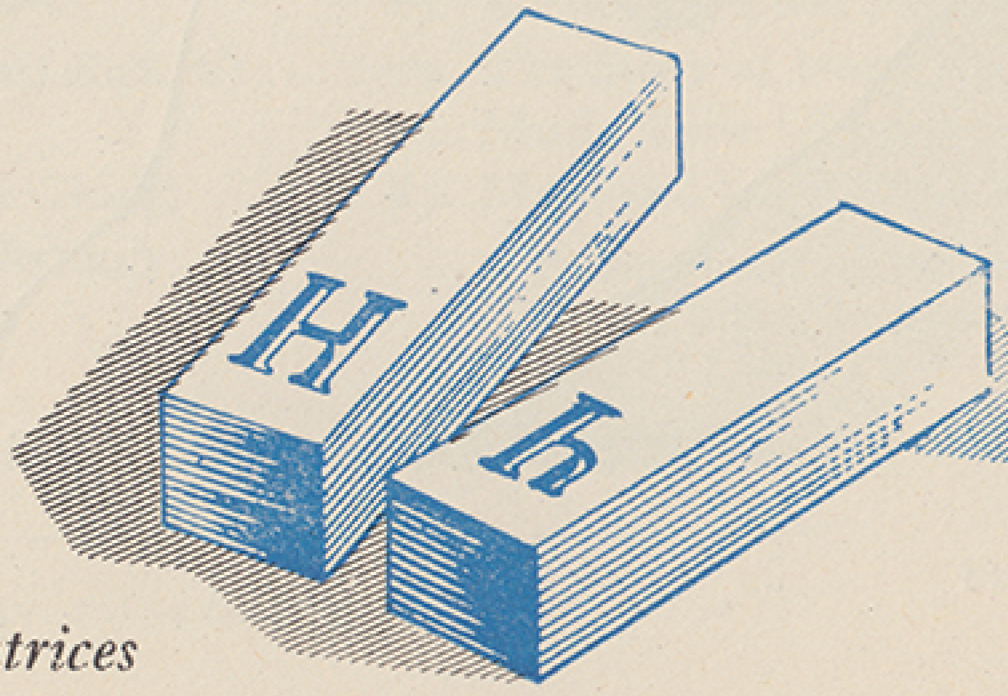
It was found that a flat block of wood could be so worked on, that all except certain parts were cut away to a lower level. This block could be dabbed with black ink and then have paper pressed upon it. This resulted in a print, or impression, of the woodblock on the paper. Not one copy but very many could be easily made or printed in this way.

At first this idea was used for pictures. Later the whole of the lettering of a page of a quill-written book was so engraved ; and such a block was made for each page of a book. But this was a cumbersome method as the work of cutting the letters had to be done over and over again.

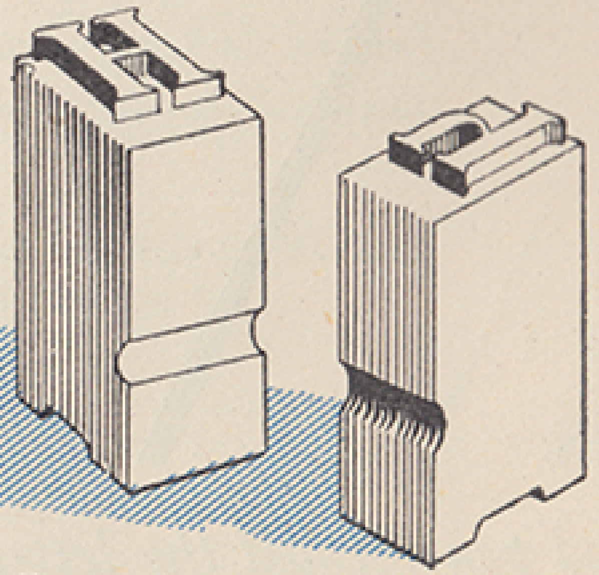
Soon someone thought of casting metal letters, or 'types', as they are called. These could be accurate as



Steel punches



Matrices



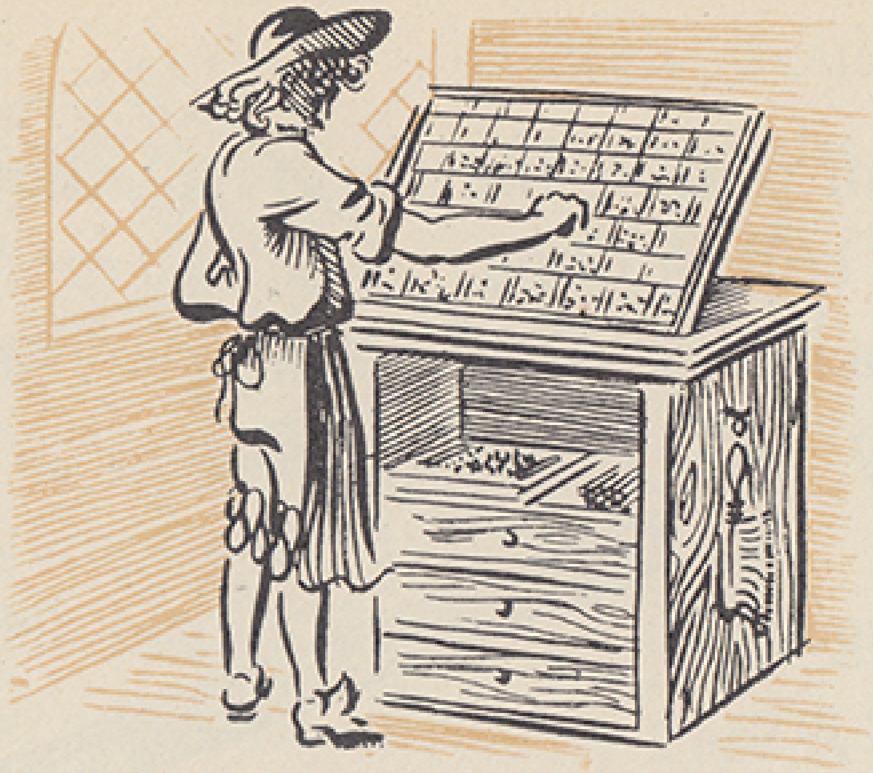
Cast types

to size and height, and printing began to take on a more clean and smart appearance. The letter was shaped on the end of a small punch of steel by filing away what was not wanted. This punch was then struck into a block of bronze, and the sunk impression formed the mould for the face of the type. The same method is used today, except that the punch is engraved in a machine which works automatically from a large model.

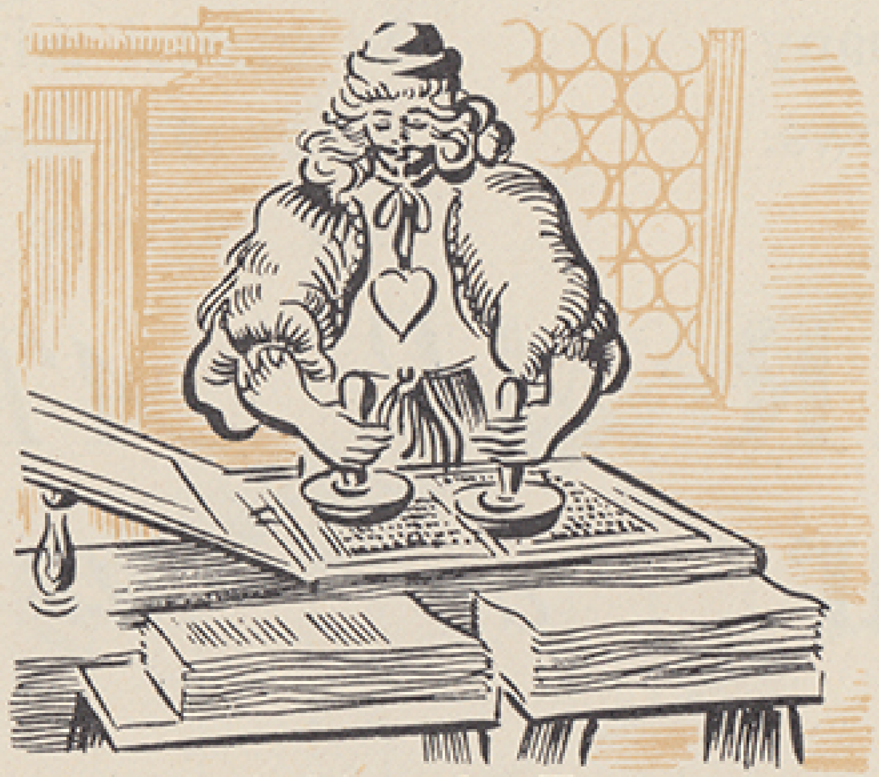
Of course, all this time there was a great deal of feeling amongst the scribes. They thought that this new-fangled method of making books in quantities was going to deprive them of their livelihood, and in any case that it was a poor makeshift for a properly written book.

However, about the year 1450, certain pioneers saw that there was great use in this new idea. It would make possible the production of very much greater numbers of books, so that many more people could read them.

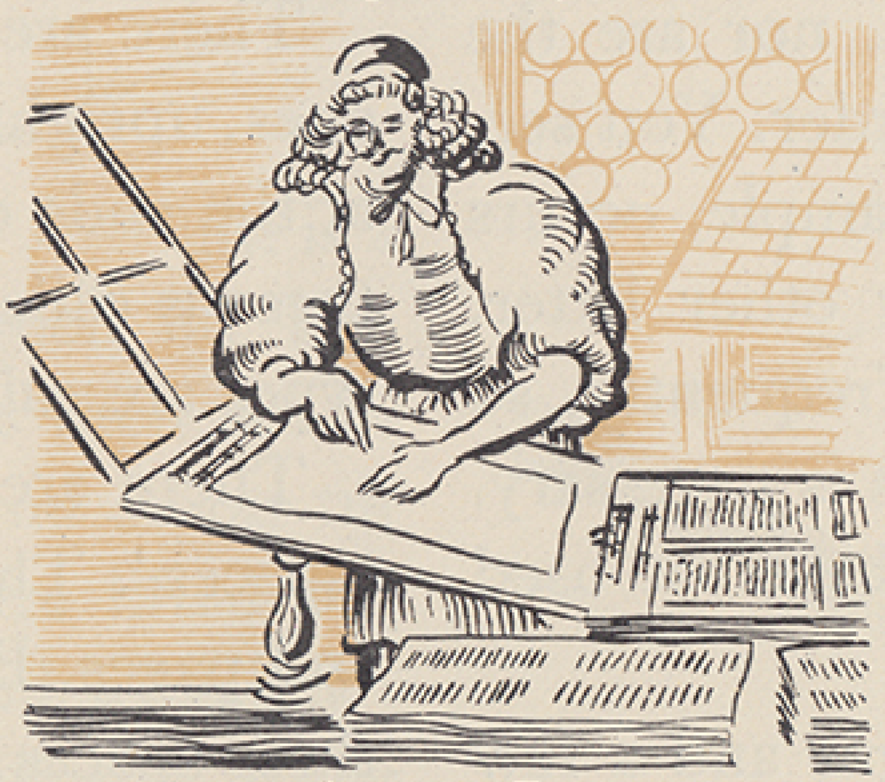
The first attempts at printing were very rough. These pictures give you some idea of the very simple apparatus of the early printers. You have probably found the difficulty of making a clean, sharp print from a linoleum cut already. A method had to be worked out for applying an even but firm pressure all over the printing surface, and until this was done, the quill-writing was much finer and neater than the printed copies.



Setting up the Type



Inking the Type



Laying on Paper

In these drawings you see first, the type setter at work. He is picking the metal types out of the case one by one, and arranging them in order.

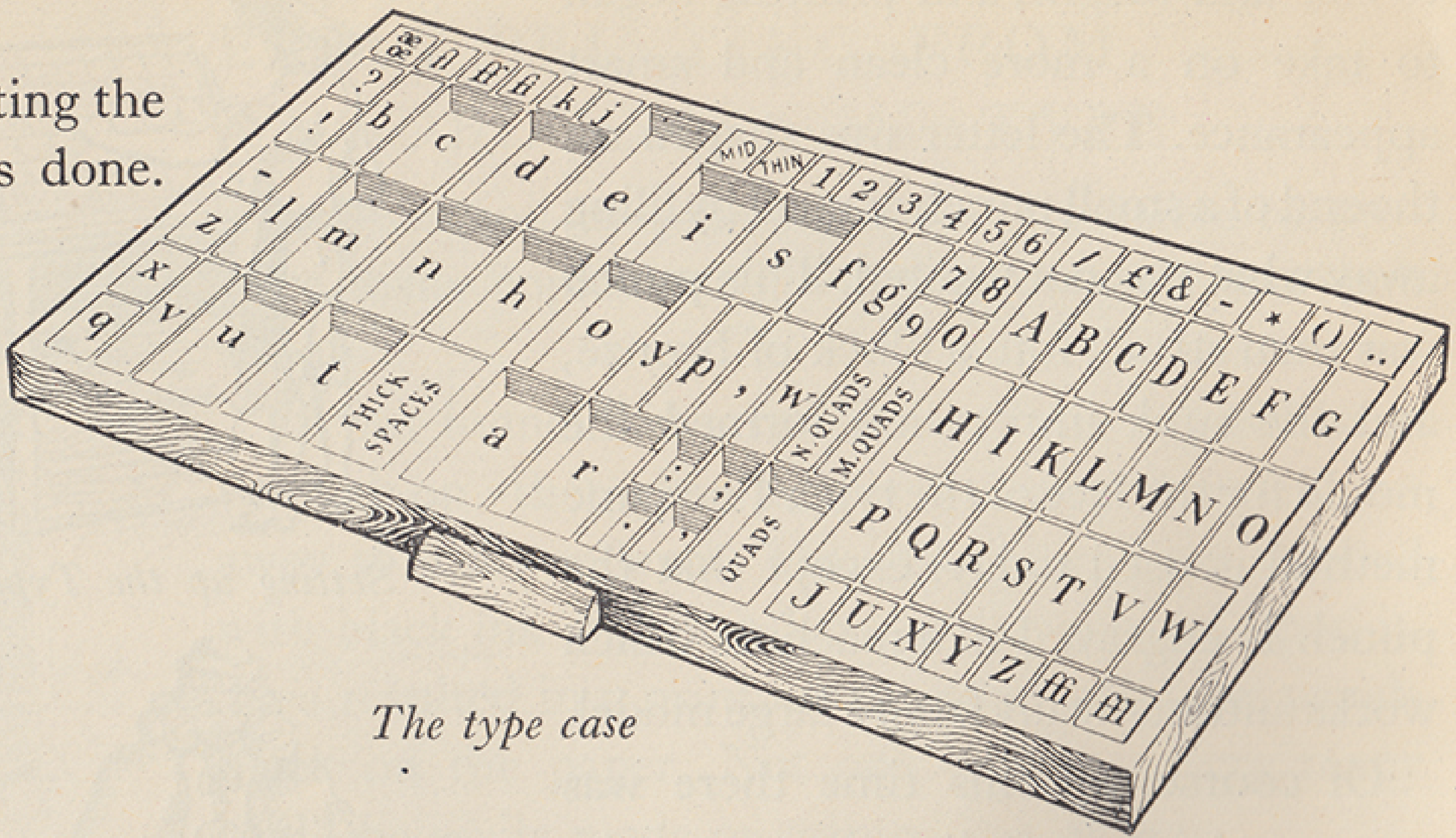
Then you see another man applying ink to the type pages with his old-fashioned, leather-covered dabbers. He would have a flat slab beside him, on which he could work up an even film of ink, to keep his dabbers evenly supplied.

The third man is placing a clean sheet of paper on the hinged flap, or 'tympan' of the press. The open frame or 'frisket' shown would then be folded down on to this, and the two together brought over on to the type.

THE PRESENT DAY

First we must see how the actual work of putting the types together was done, and indeed, still is done. The method has not changed in general idea, although much greater accuracy of finish has gradually come in.

When the types are not in use in pages, they are kept in trays, or 'cases'. These are of a standard size so that they can fit into cabinets. Each case is divided up into many little boxes, as the drawing here shows.



The type case

AR AR AR AR AR AR AR AR AR

ar ar ar ar ar ar ar ar

Many designs of type are available

The boxes are not all the same size, nor are the letters put into them in alphabetical order. You see, in our language, the letter 'e', for example, occurs very much more frequently than any other letter. Other letters are used more or less frequently, so that a variation in the size of the boxes is necessary. Also it saves much time to arrange the most used types near to the hand.

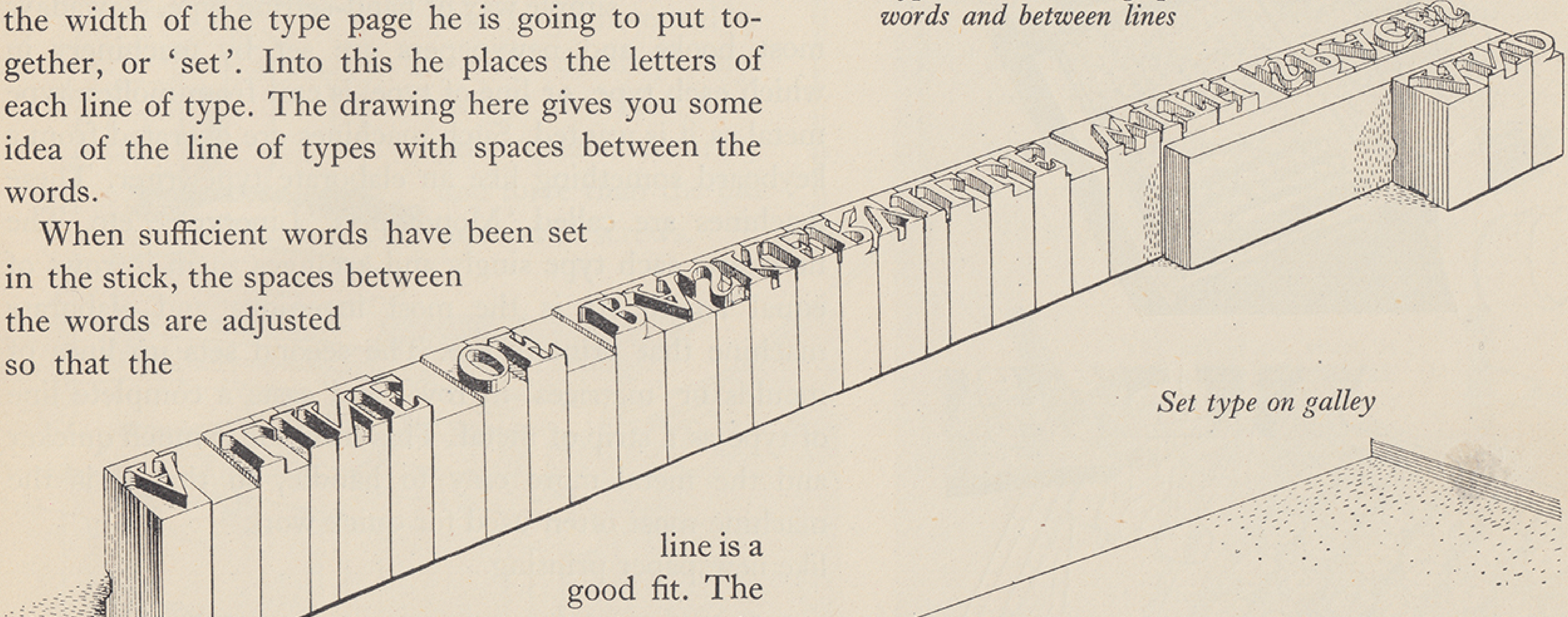
Types are, moreover, of many designs and a few examples are shown above.

There are heavy and light types, plain and fancy ones, upright and sloping ones. The little cross strokes at the ends of letters are called serifs. Type without these is called sans serif, or 'sans' for short. Upright types are called Roman, sloping ones italic.

There are pieces of metal of various sizes called 'spaces'. The type is put together into words, lines and pages. Between every word and the next, one of these spaces, which are of less height than the types, is inserted.

SETTING UP THE TYPE

The type has to be cast the wrong way round so that a print from it shall be the right way. Therefore, the compositor has trained himself to look at type upside down rather than read it the right way up and from right to left. The compositor stands in front of the case, which is on a high, sloping stand. He has in his left hand a clamp or 'stick' which can be adjusted to the width of the type page he is going to put together, or 'set'. Into this he places the letters of each line of type. The drawing here gives you some idea of the line of types with spaces between the words.

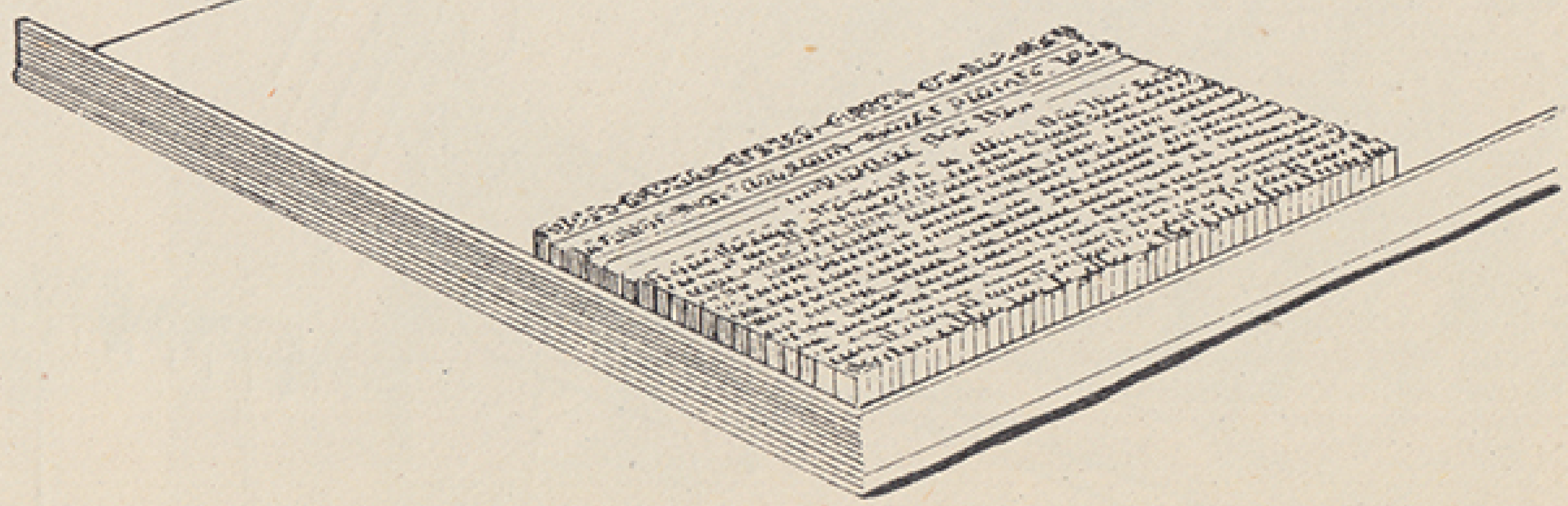


Type in line showing spaces between words and between lines

When sufficient words have been set in the stick, the spaces between the words are adjusted so that the line is a good fit. The next line is then set in the same way and so on till the stick is full. Then all the lines are lifted out together and laid on a special tray called a 'galley'. This requires great care as the block of metal in the stick is made up of very many little metal pieces which would easily be spilled, or 'pied' as the printer calls it.

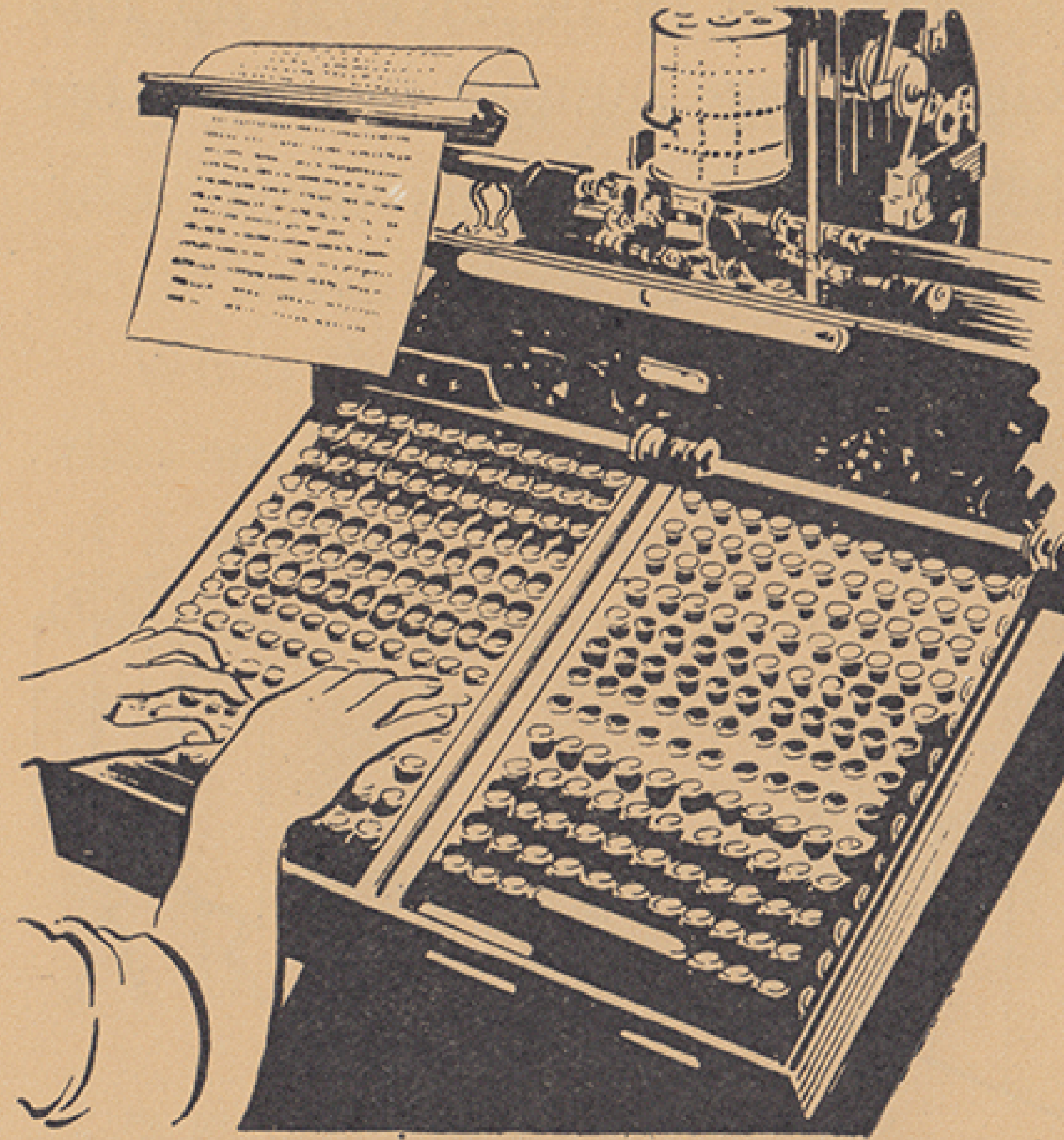
After that the work has to be divided up into pages, with a 'folio' or page number in one corner and possibly a head-line.

Set type on galley

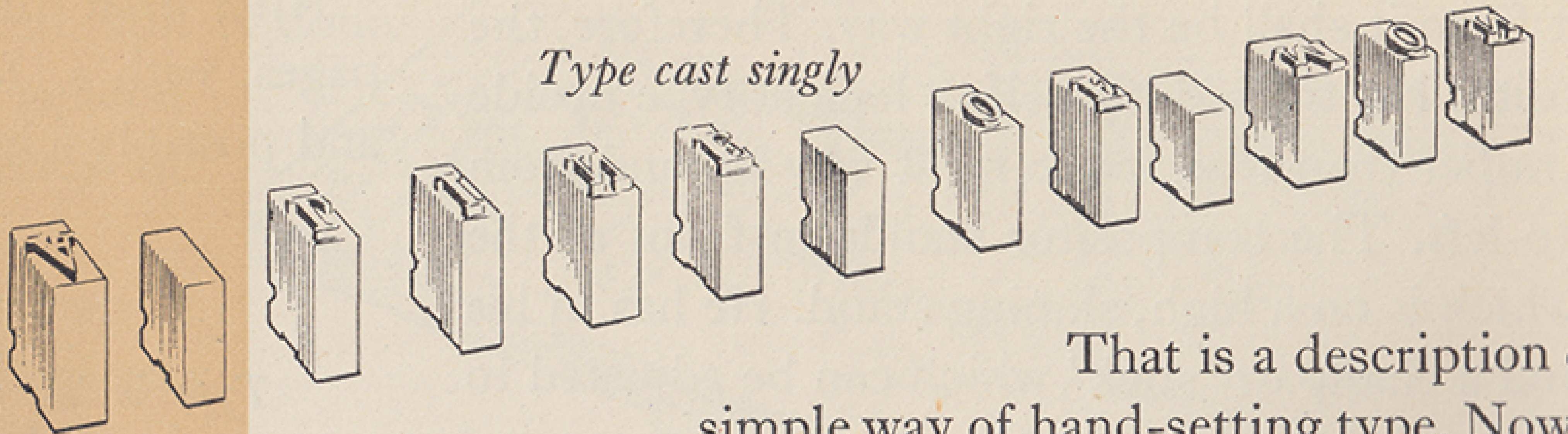


SETTING TYPE BY MACHINE

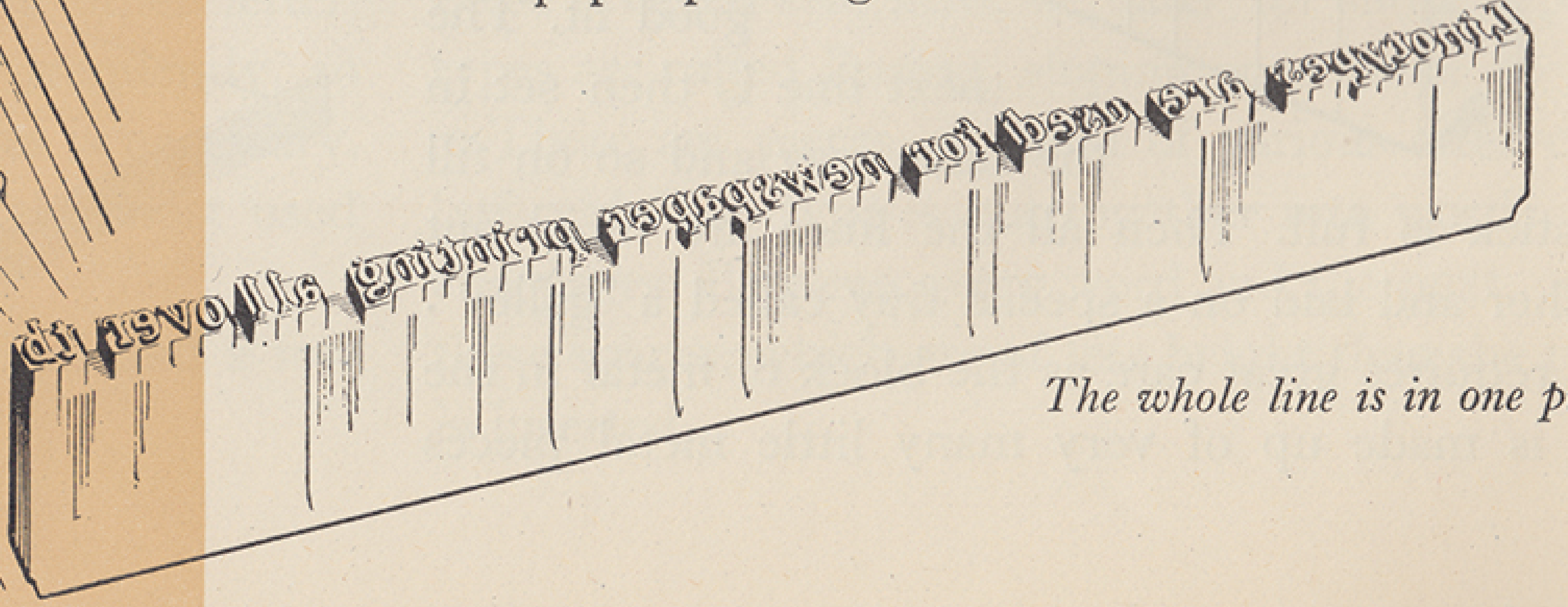
Monotype keyboard



Type cast singly



That is a description of the simple way of hand-setting type. Nowadays most books and newspapers are set by machinery in which each type, or line of type, is cast from molten type metal as it is wanted. Such machines are operated from a keyboard something like an elaborate typewriter. These machines are called 'Monotype', 'Linotype', etc. The first casts each type singly and arranges them in rows of equal length. It is the most ingenious and elaborate machine that printers use. The second sets up lines of moulds or 'matrices' in rows and casts a complete line of type as a strip of metal. This machine is much quicker and the metal more easy to handle, so that it is the machine most often used for quick work like newspaper printing.



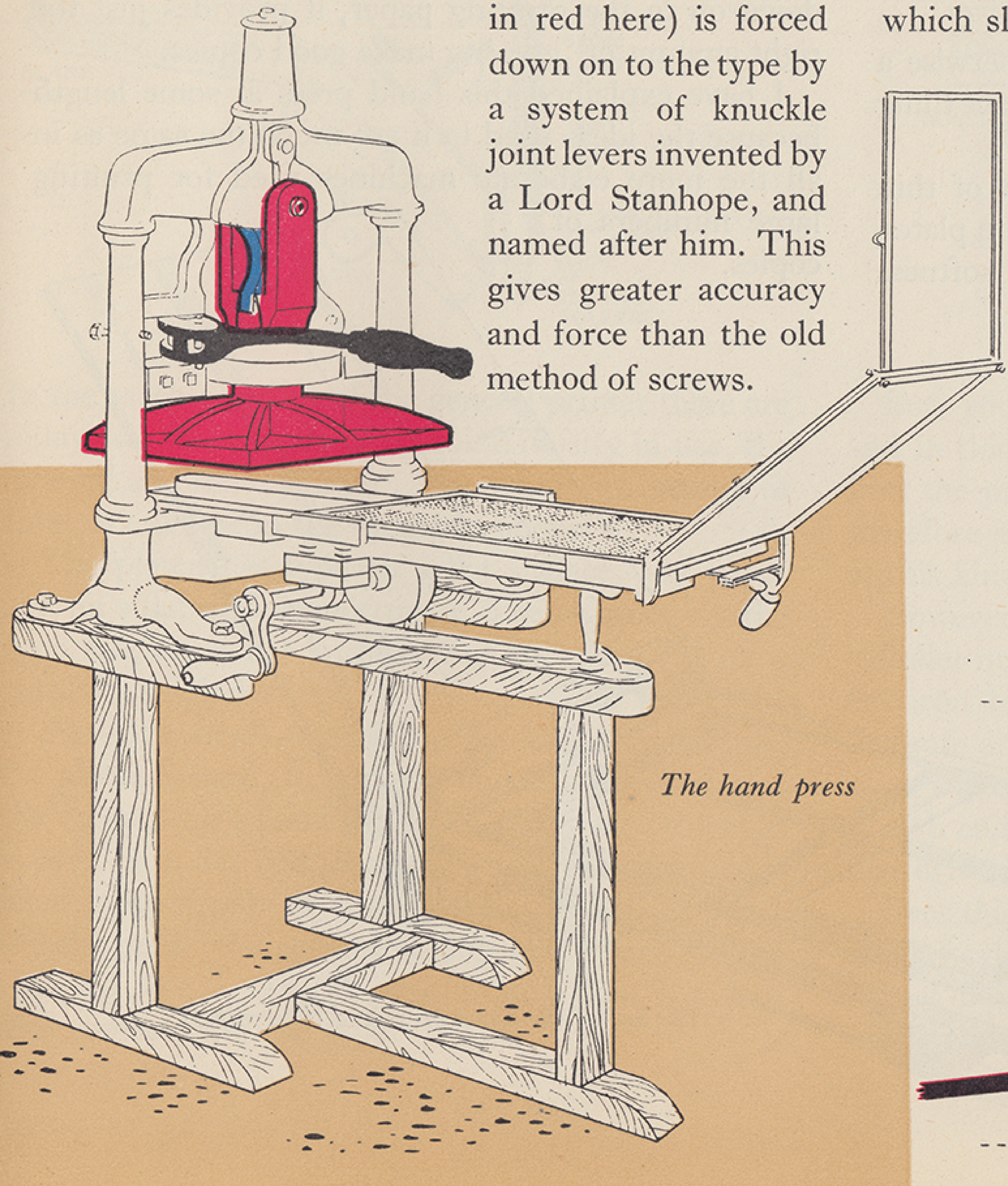
The whole line is in one piece

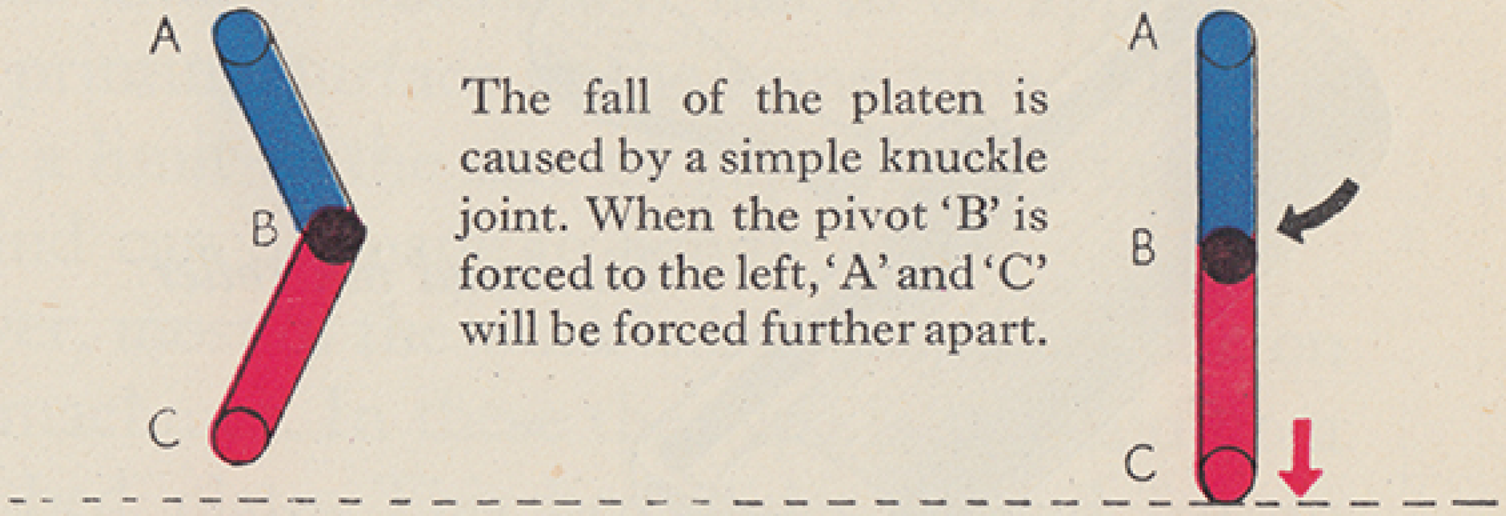
Linotype keyboard

PRINTING THE COPIES

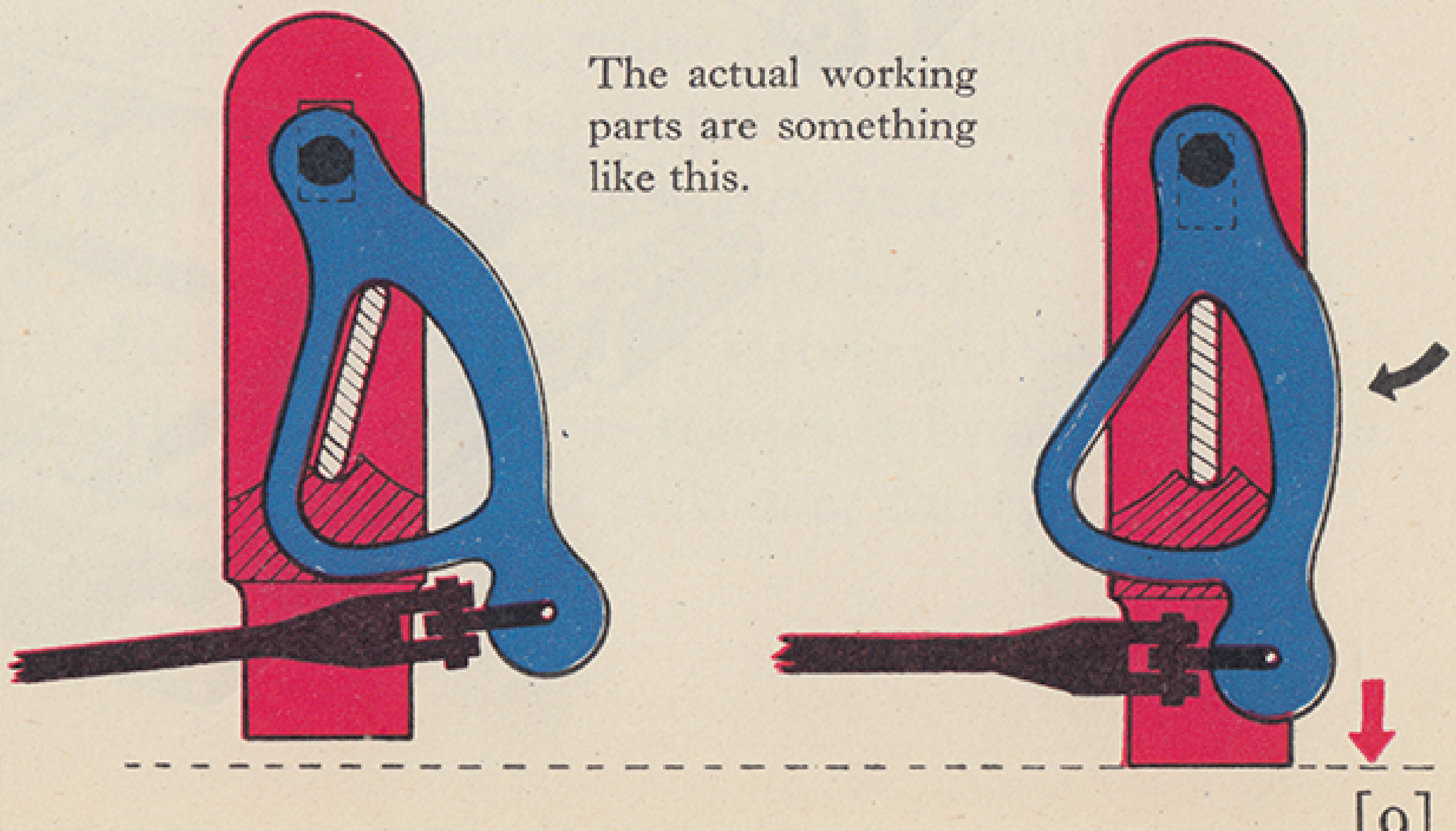
Now comes the exciting process of printing off the copies. The simplest machine used is very like the original hand press of the early printers. Now, however, the platen (shown in red here) is forced down on to the type by a system of knuckle joint levers invented by a Lord Stanhope, and named after him. This gives greater accuracy and force than the old method of screws.

First then comes the 'hand press', on which the printer takes a 'proof' or trial copy of each page or piece of printing. It is on this press that you can best take copies of your own linoleum cuts if you can borrow the use of one. There is a solid cast-iron 'bed' which slides on oiled runners under a similar cast-iron 'platen'. Both these plates have accurately machined surfaces and they must work in absolute parallel to one another. The platen is so attached to a long lever handle that when it is pulled, the platen sinks about $\frac{1}{4}$ inch, and so presses a sheet of paper firmly on to the type or block which has been laid on the bed.


The hand press



The fall of the platen is caused by a simple knuckle joint. When the pivot 'B' is forced to the left, 'A' and 'C' will be forced further apart.

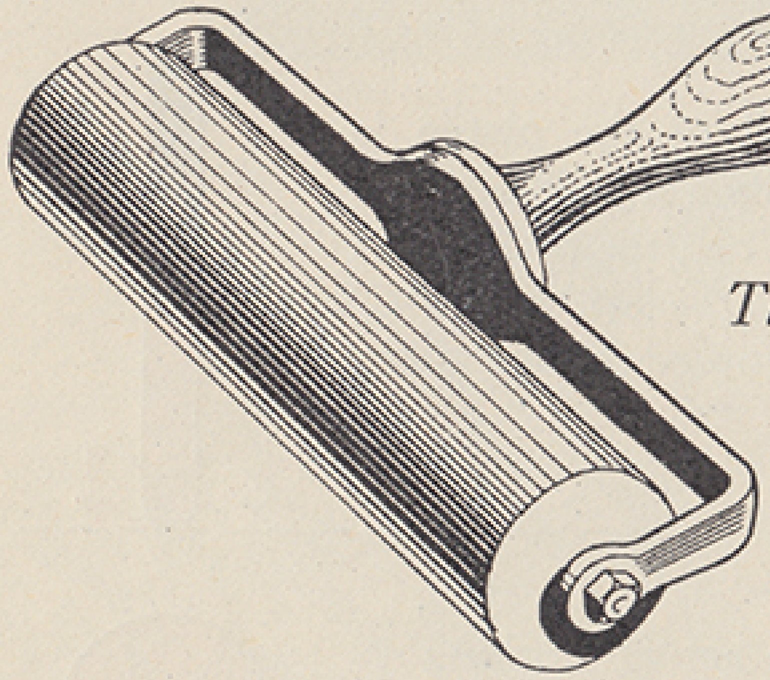

The actual working parts are something like this.

INKING AND IMPRESSION

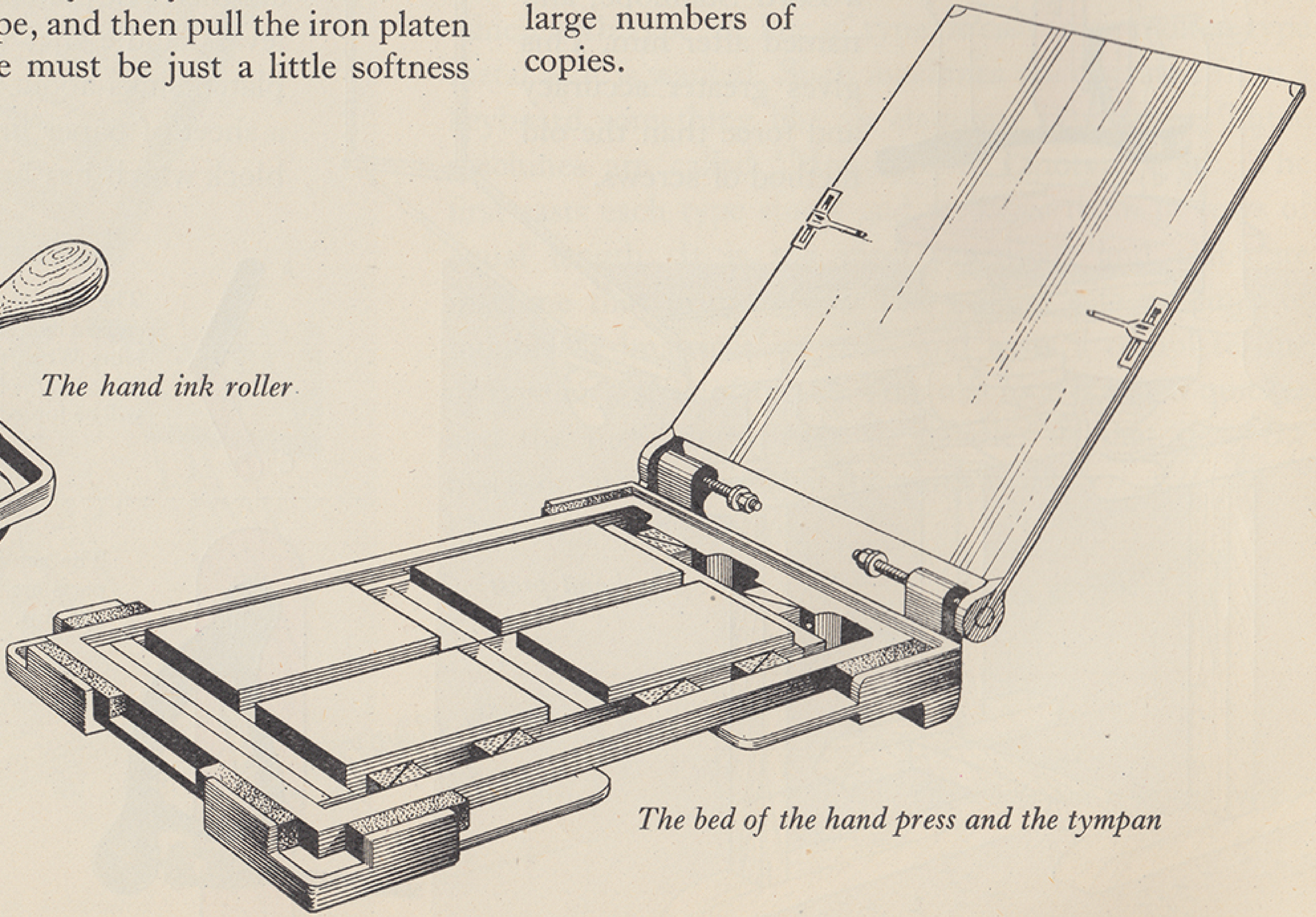
Ink is applied to the type or block with a roller made of a composition of glue, treacle and glycerine. The roller is held in an iron fork and has a wooden handle. Ink is spread on a flat iron plate, and rolled out many times with the roller till an even film is formed. Very little ink actually is used, otherwise a sharp impression will not result. The important thing is the even firmness of the pressure.

Of course you cannot just lay one sheet of thin paper on the inked type, and then pull the iron platen down on to it. There must be just a little softness between platen and type. So a hinged flap or 'tympan' is provided. This is composed of a thin double-steel frame which has a pair of sheets of vellum, or linen, stretched on it. Between these a couple of sheets of paper can be placed, and when this tympan is brought down on to the printing paper, it provides just the right amount of 'give' to make good copies.

I have explained this hand press at some length because the ideas used in it are much the same as in all the more elaborate machines used for printing large numbers of copies.

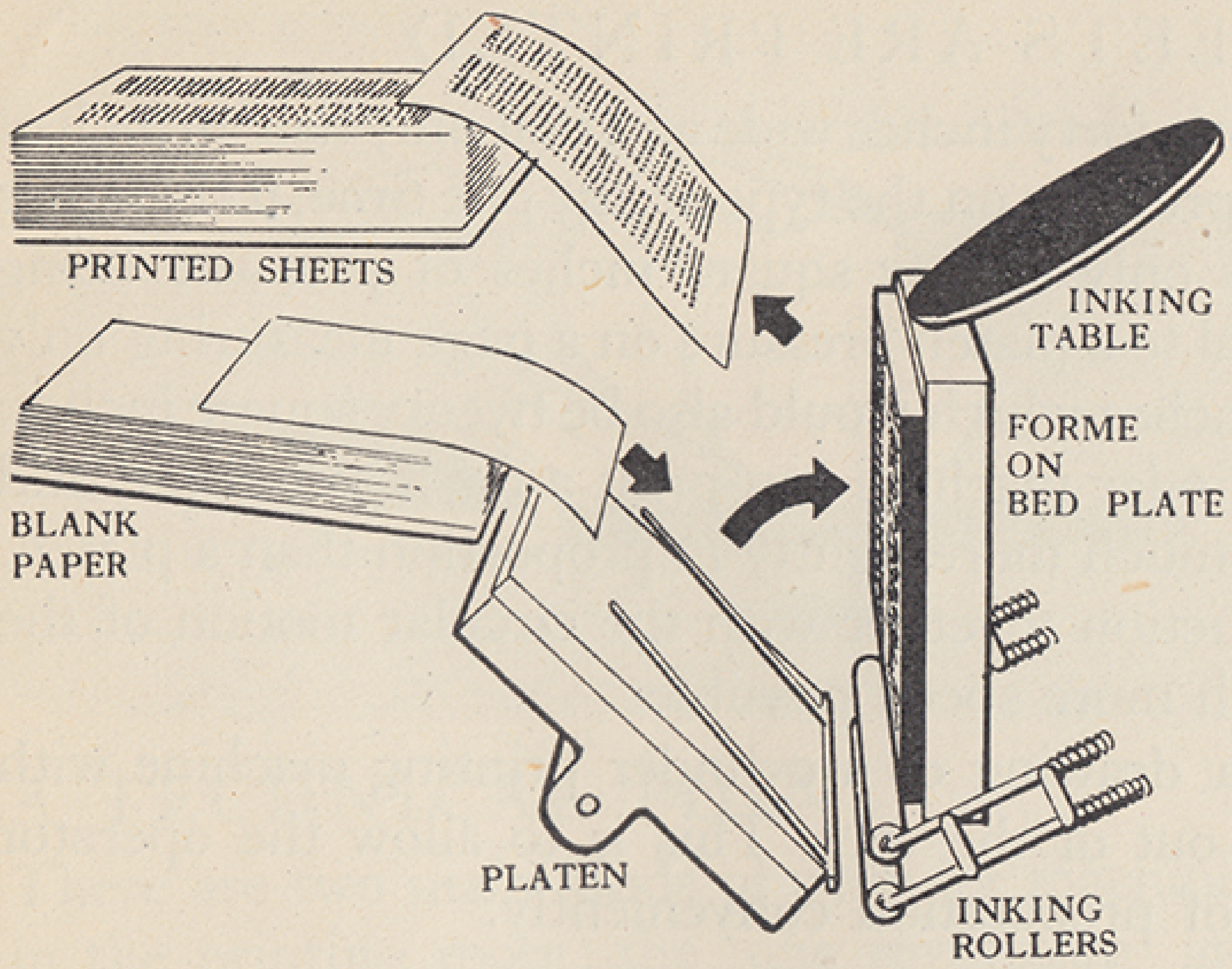


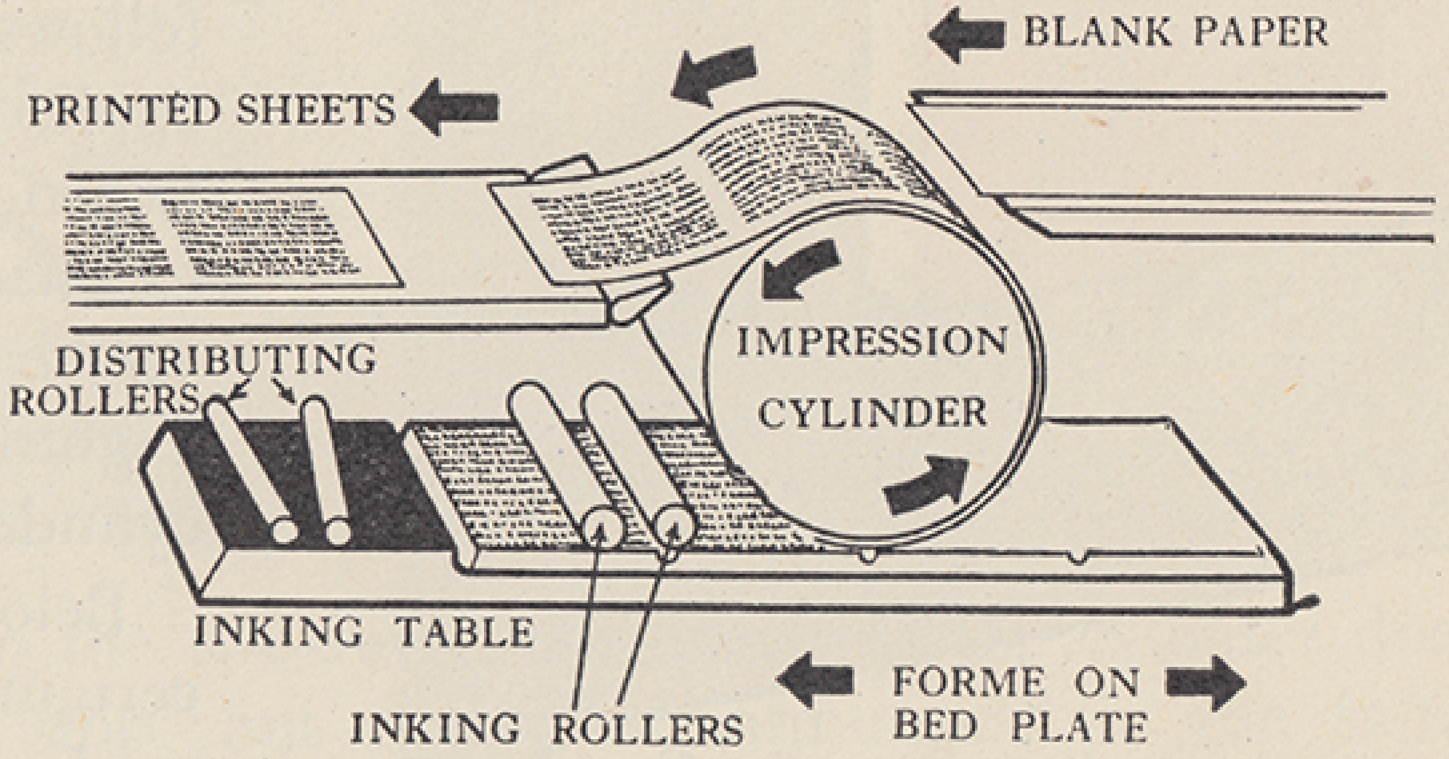
The hand ink roller



The bed of the hand press and the tympan

PLATEN AND CYLINDER MACHINES





In the machine room of the general printer there are today two main kinds of machine mostly in use, the ‘platen’ and the ‘cylinder’. The general principles of these are shown in the diagrams above.

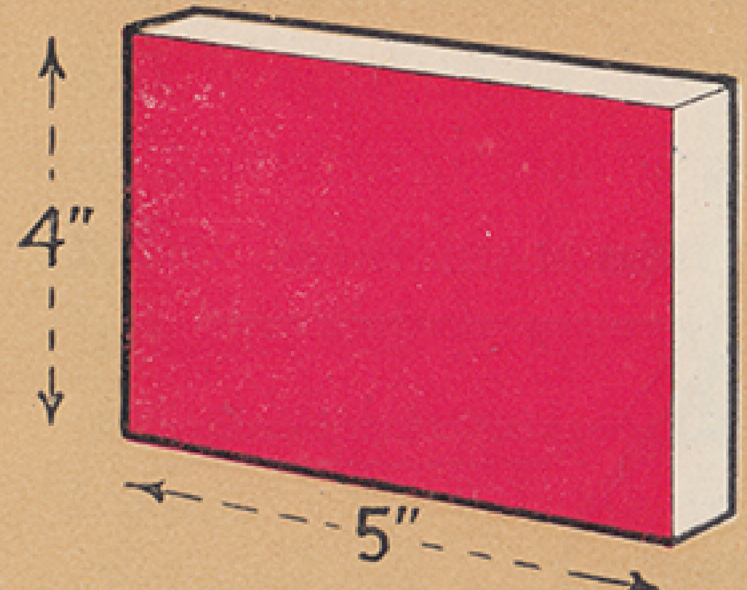
The platen has type on a flat surface, and paper also on a flat surface meeting it. The cylinder has the type still on a flat surface, but the paper is on a revolving cylinder.

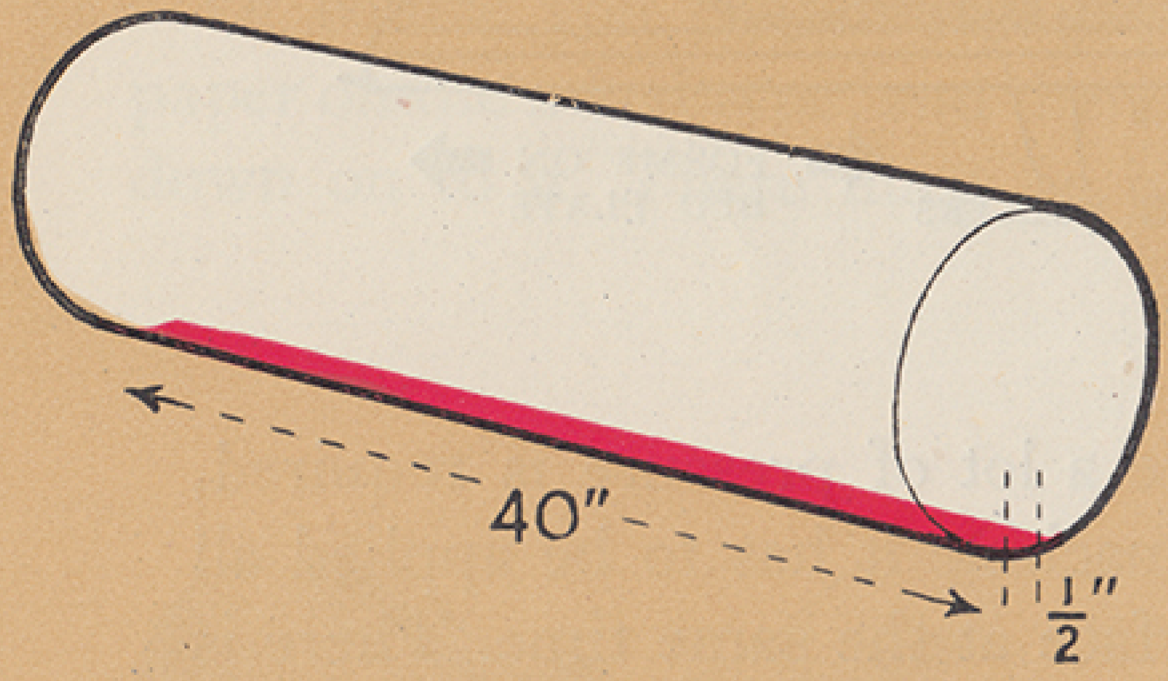
For quite small-sized jobs, like leaflets and cards, the platen is used. It works in much the same way as the compositor’s hand press. That is to say, the type is held on a flat bed, though in this case the bed is fixed quite rigidly in a vertical position. The paper is held on a rocking and sliding iron platen, which rises up into a vertical position and then is forced into contact with the type.

But, you see, quite a lot of pressure is required, and in this kind of machine it has to be applied all over the printing surface at the same time. There is therefore a limit to the size of paper that a machine of this kind can be made to handle.

However, most of the work is larger and is done on cylinder machines. In these the type is still laid on a flat iron bed plate. This bed slides to and fro on accurate and very strong roller tracks. Often there is an air buffer at each end so that the bed bounces back at each end of its travel. This saves wear on the gears that drive it and makes quieter working.

Over this bed is fixed a very strong and accurately ground cylinder. When this rotates it brings with it a sheet of paper, and this it rolls over the type on the bed of the machine.



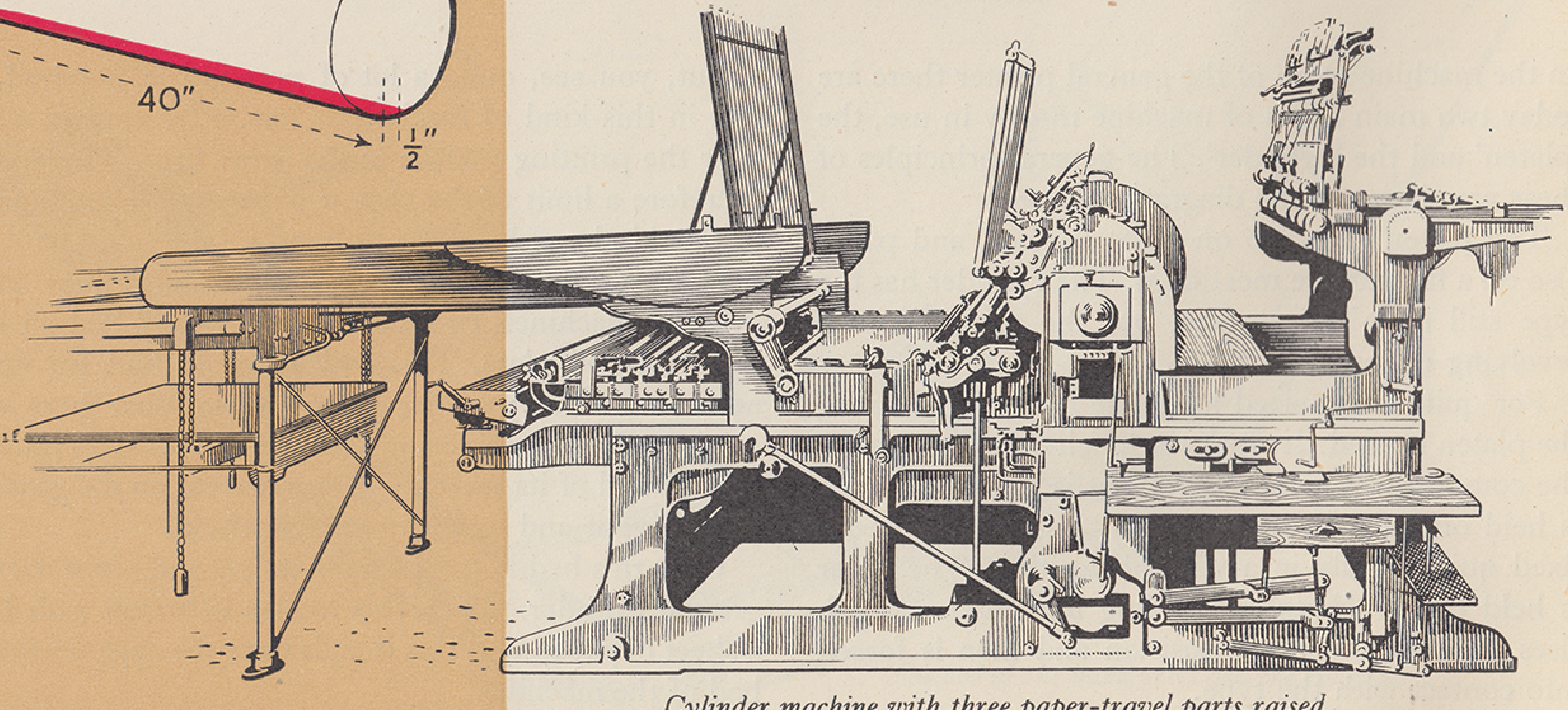


HOW BIG SHEETS ARE PRINTED

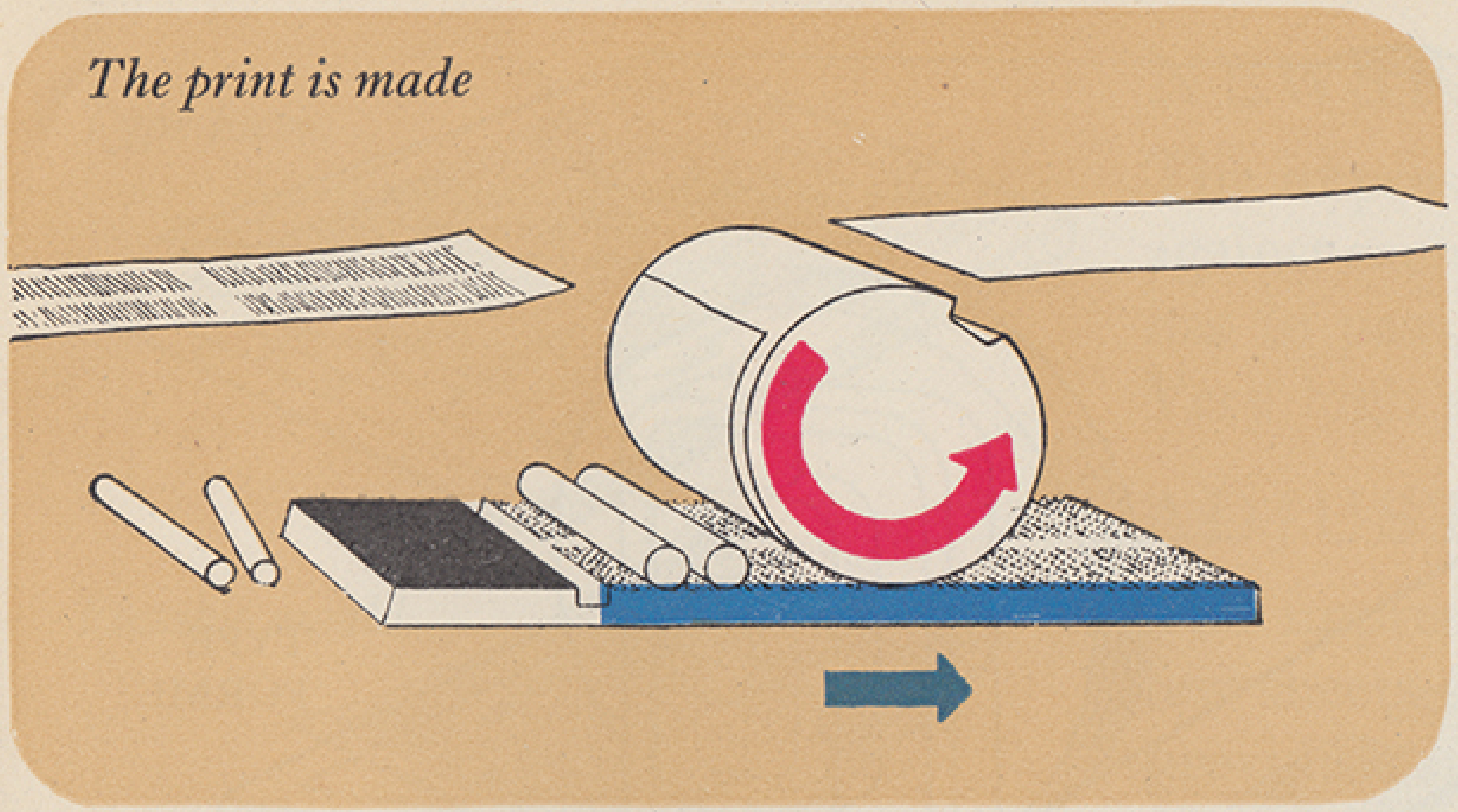
Suppose the cylinder is forty inches wide and that only half an inch of its circumference is pressing on the type at any one time, it therefore follows that there is only twenty square inches of pressure being applied. This is equal to a platen pressure on a page measuring only five inches by four inches which would also be twenty square inches.

That is why a cylinder machine can print a far larger sheet, and yet be built so very much more lightly in proportion than a platen. Lightness of construction together with the circular motion of the cylinder makes much more speed possible.

Below you have a drawing of a cylinder printing machine with certain parts raised out of the way. This is to allow the operator to do all the work of preparation conveniently.



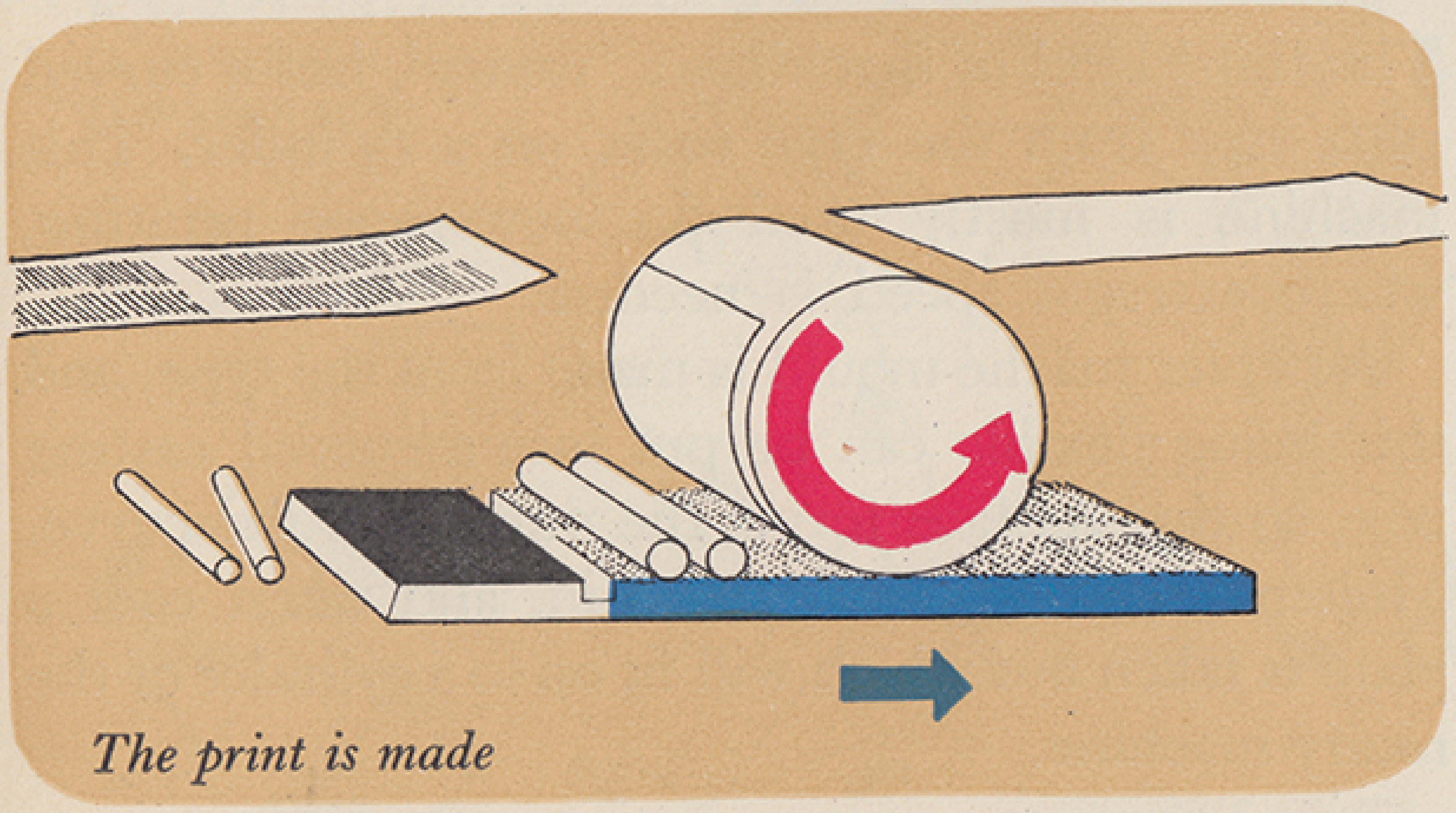
Cylinder machine with three paper-travel parts raised



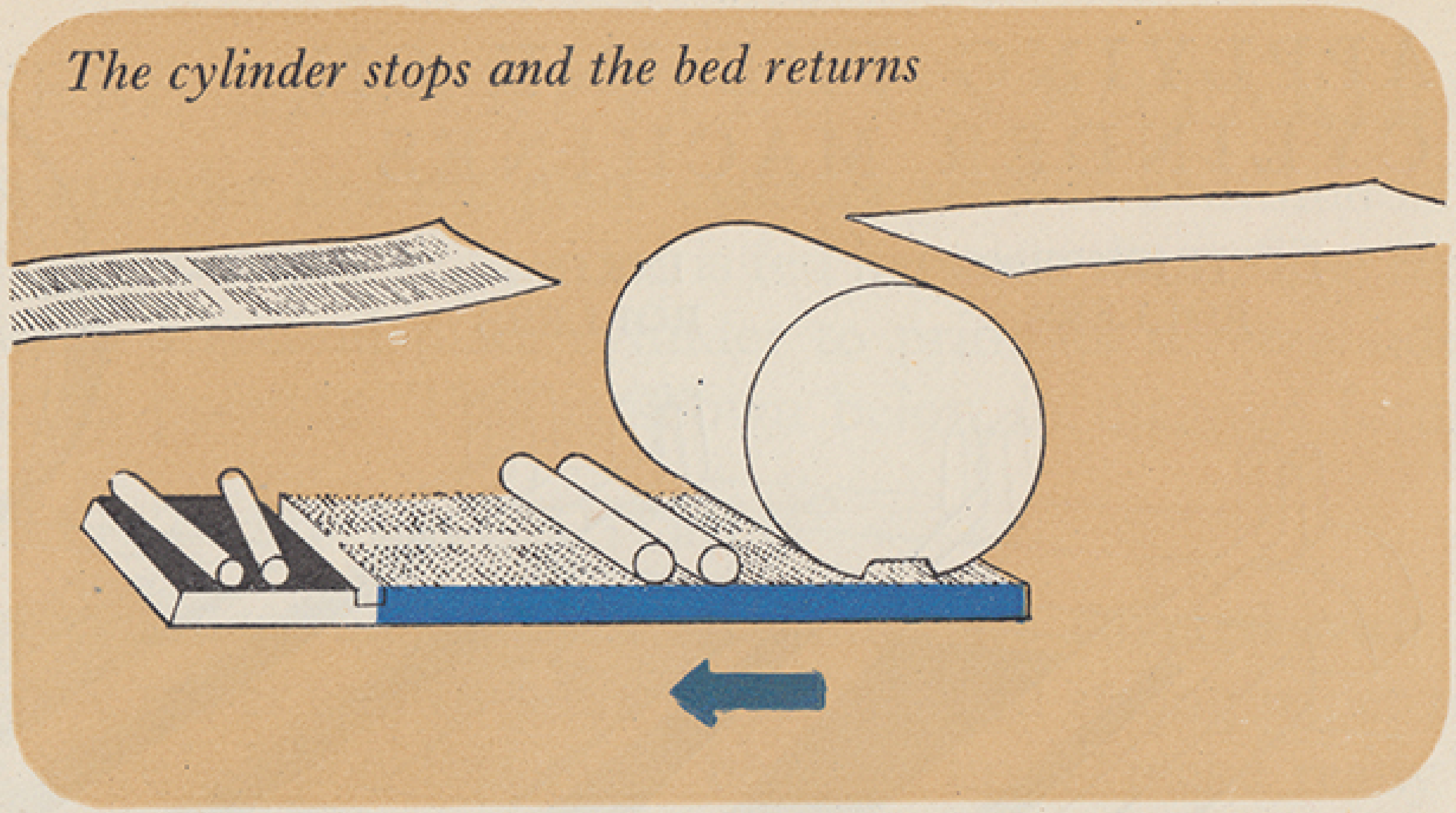
The print is made

A TECHNICAL POINT

There are two main kinds of cylinder machine used in the printing room; the 'one revolution' and the 'two revolution'. When the bed of either machine is travelling in one direction, the cylinder rolls on it, making the impression. When the bed returns, however, the cylinder of the first kind stops, with a flat on its circumference at the bottom, so that the type can pass without touching.

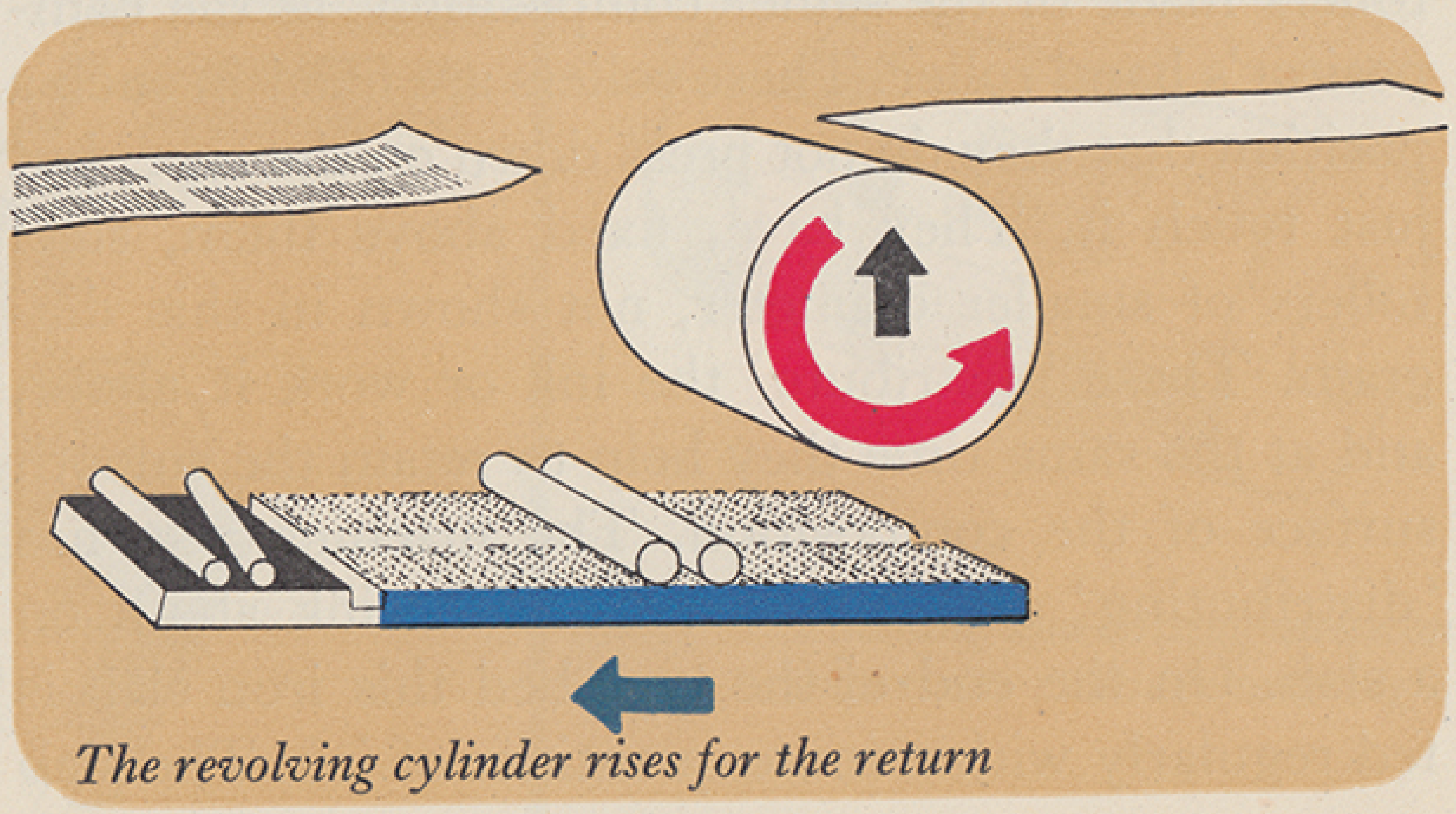


The print is made



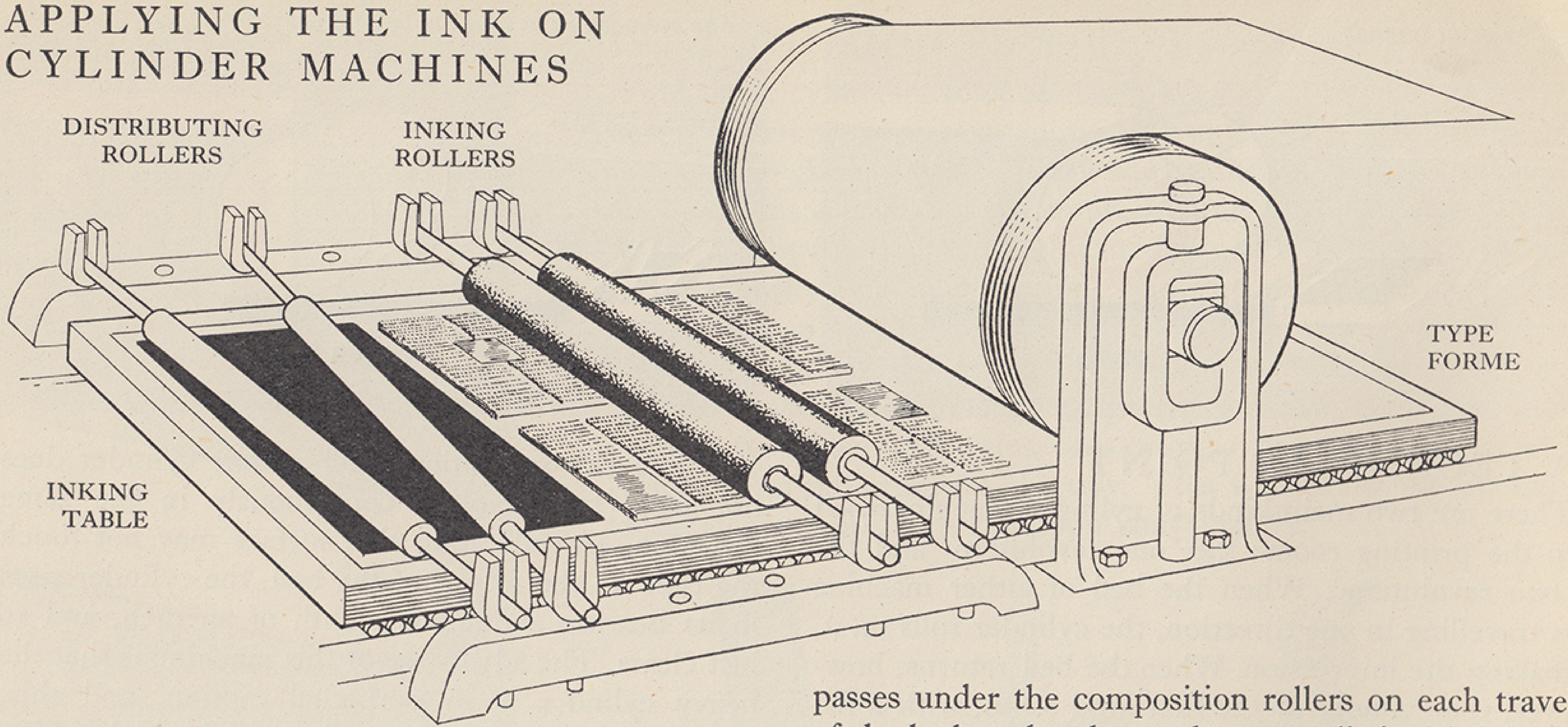
The cylinder stops and the bed returns

In the two-revolution machine the cylinder does not stop, but revolves continuously in the same direction. In order that this surface may not touch the type on the return of the bed, the cylinder rises in its bearing about one eighth of an inch, and so just clears. The advantage of this machine is that the heavy cylinder is in perpetual motion, and this, together with pneumatic buffers on the bed, makes the machine very smooth running and silent.



The revolving cylinder rises for the return

APPLYING THE INK ON CYLINDER MACHINES

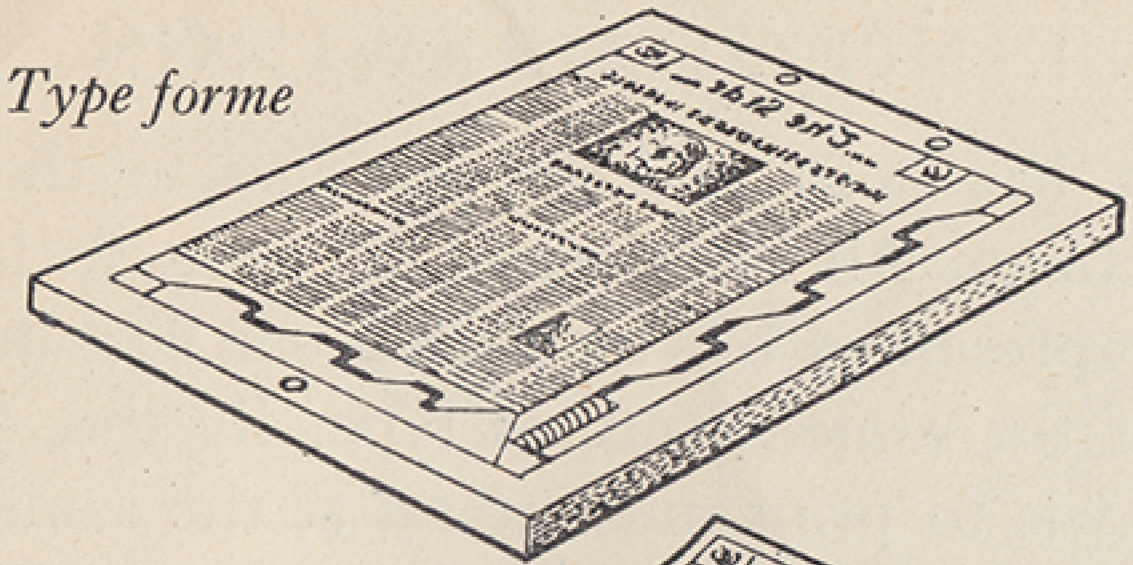


Ink on all these cylinder machines is applied by rollers made of the same ‘composition’ as the compositor’s hand roller. These rollers are fixed in such a position that they do not press down on the type, but just touch it. They have, fixed above them, steel rollers of smaller diameter, not shown in this diagram. These ‘distribute’ the ink or work it about, and at the same time they help to retain the smooth surface of the composition. The machine also has ‘distributing’ rollers which work the ink about on a slab. On the end of the type bed this iron slab is fed regularly with minute quantities of ink. The slab passes under the composition rollers on each travel of the bed, and so keeps them supplied with ink.

THE ‘ROTARY’

The third kind of machine, a ‘rotary’, has a curved plate cast from the type to fit on a cylinder. This machine is mostly used for newspaper printing, where extreme speed is needed.

A papier mâché mould is made from the type, and this being flexible can be put into a curved casting box, so that its face forms the outside of the curve. Molten metal is then poured in, and when cool a plate is taken out which will fit on to a cylinder of the rotary machine.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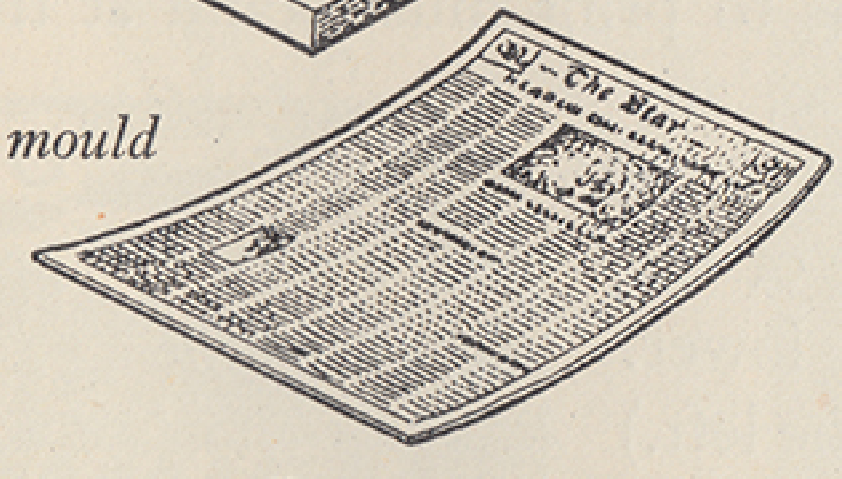
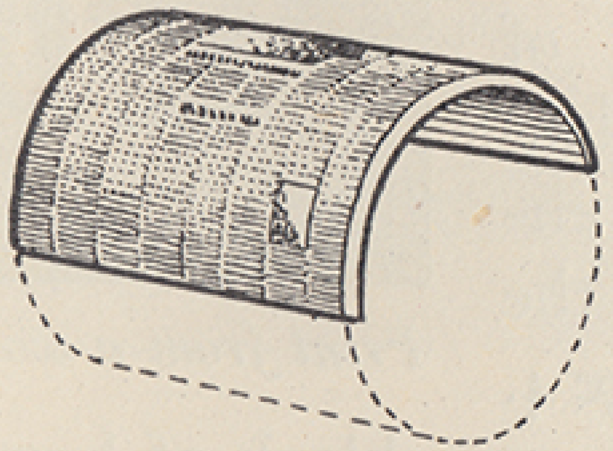

Flexible mould

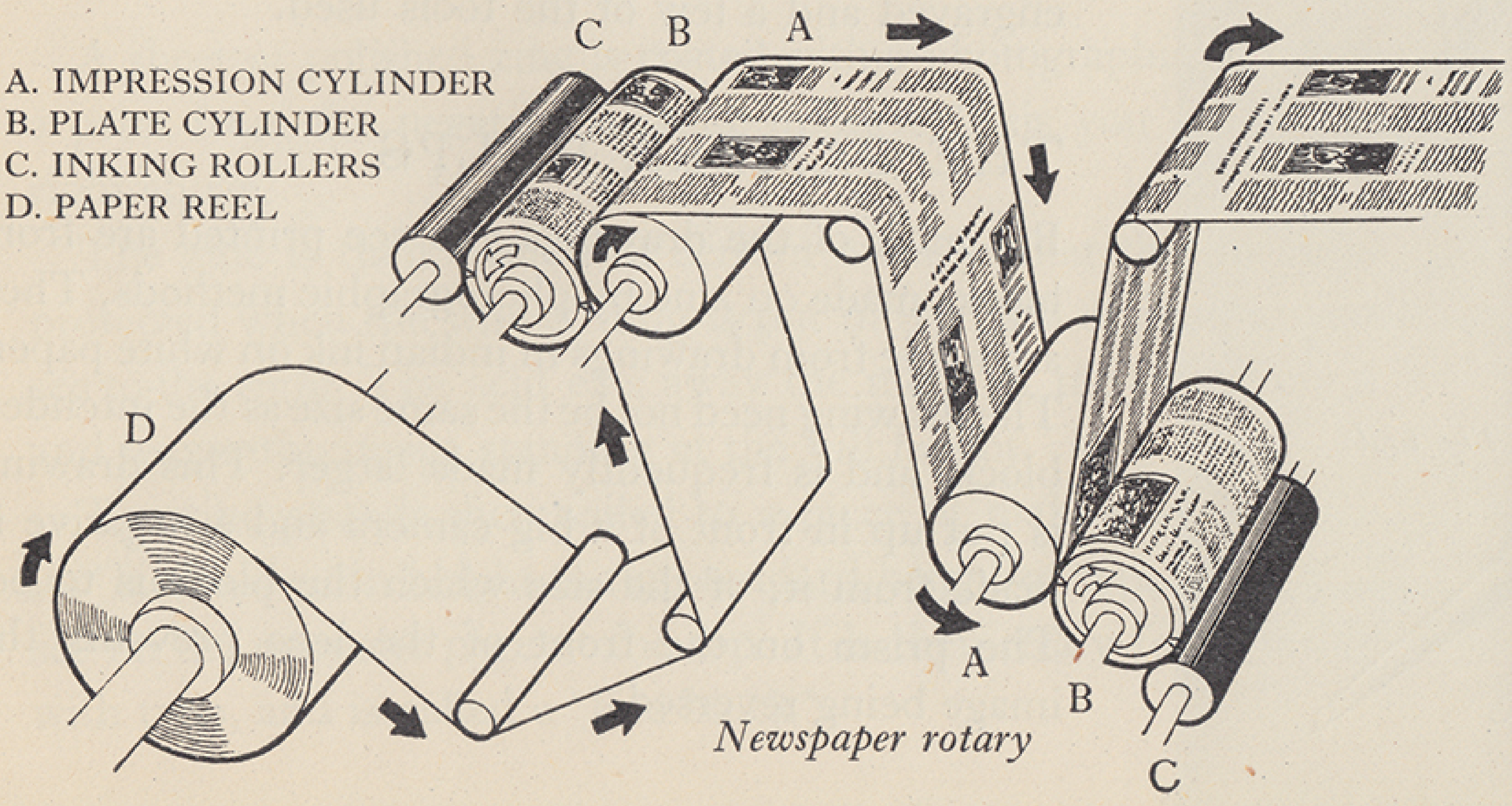

Curved plate

NEWSPAPERS ARE PRINTED ON ROTARIES

The impression cylinder and the plate cylinder revolve continuously against each other, and paper from a reel is fed between them. The reel has to pass against a second plate cylinder to print its reverse side. Very high speed is possible. This is shown below in diagram form.

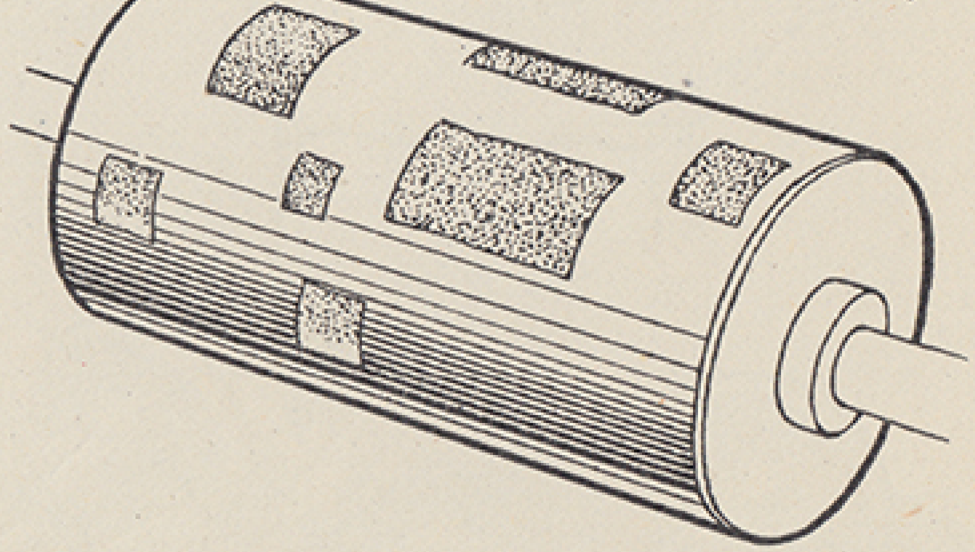
ADJUSTING THE PRESSURE

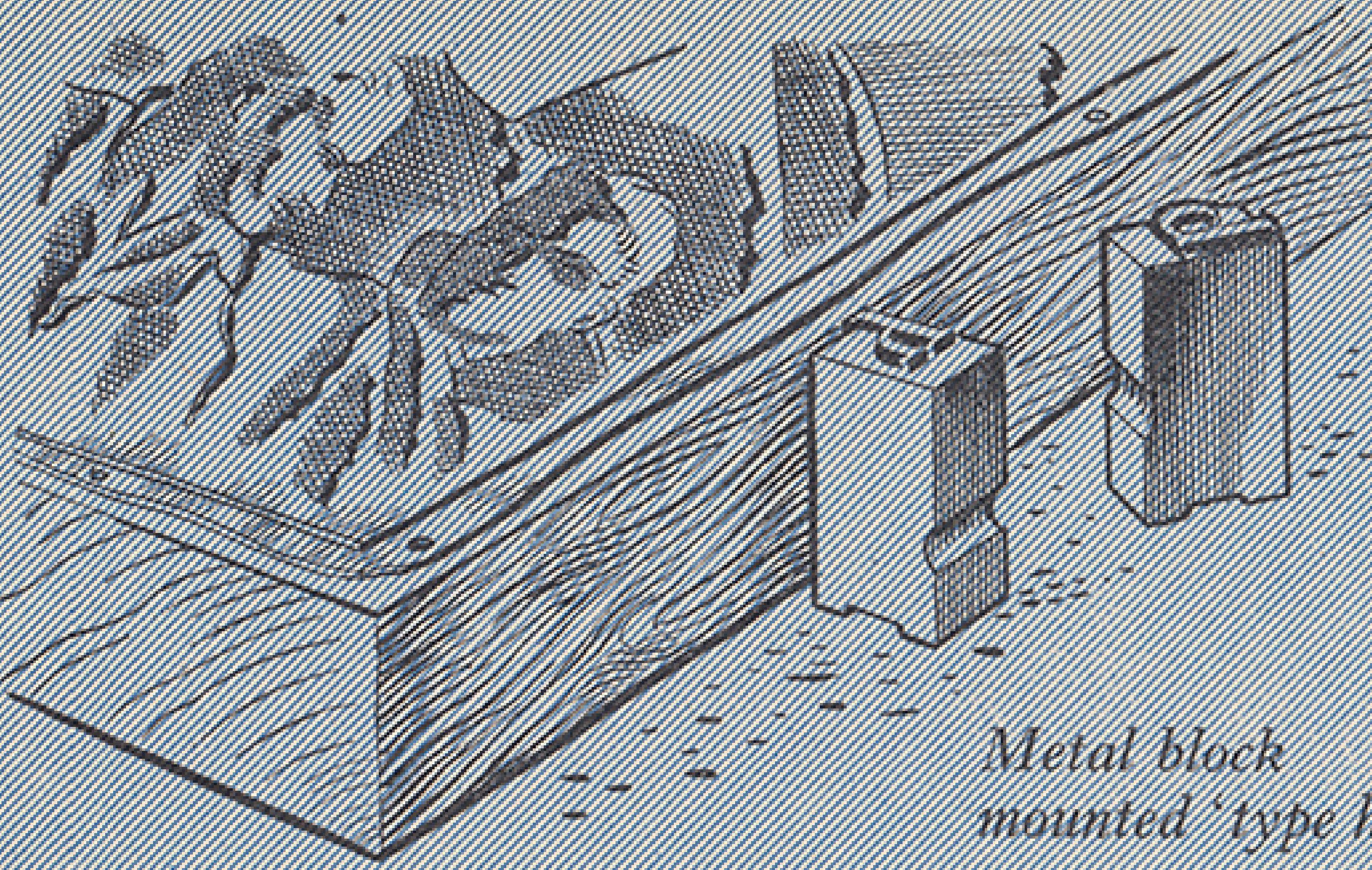
The impression cylinders on all these machines are covered with a few sheets of white paper and an outer layer of tough strong paper to provide a little 'give'. Upon this must be built up a 'make ready'. (See the picture to the right below.) That is to say, a great deal of patching on of extra layers, and cutting away of layers, wherever the first trial print shows that there is too little or too much pressure. This is most important and skilled work, and on it depends the evenness of the final prints. The setting of the mechanism, which controls the exact amount of ink fed to the inking rollers at each impression, is also most important.



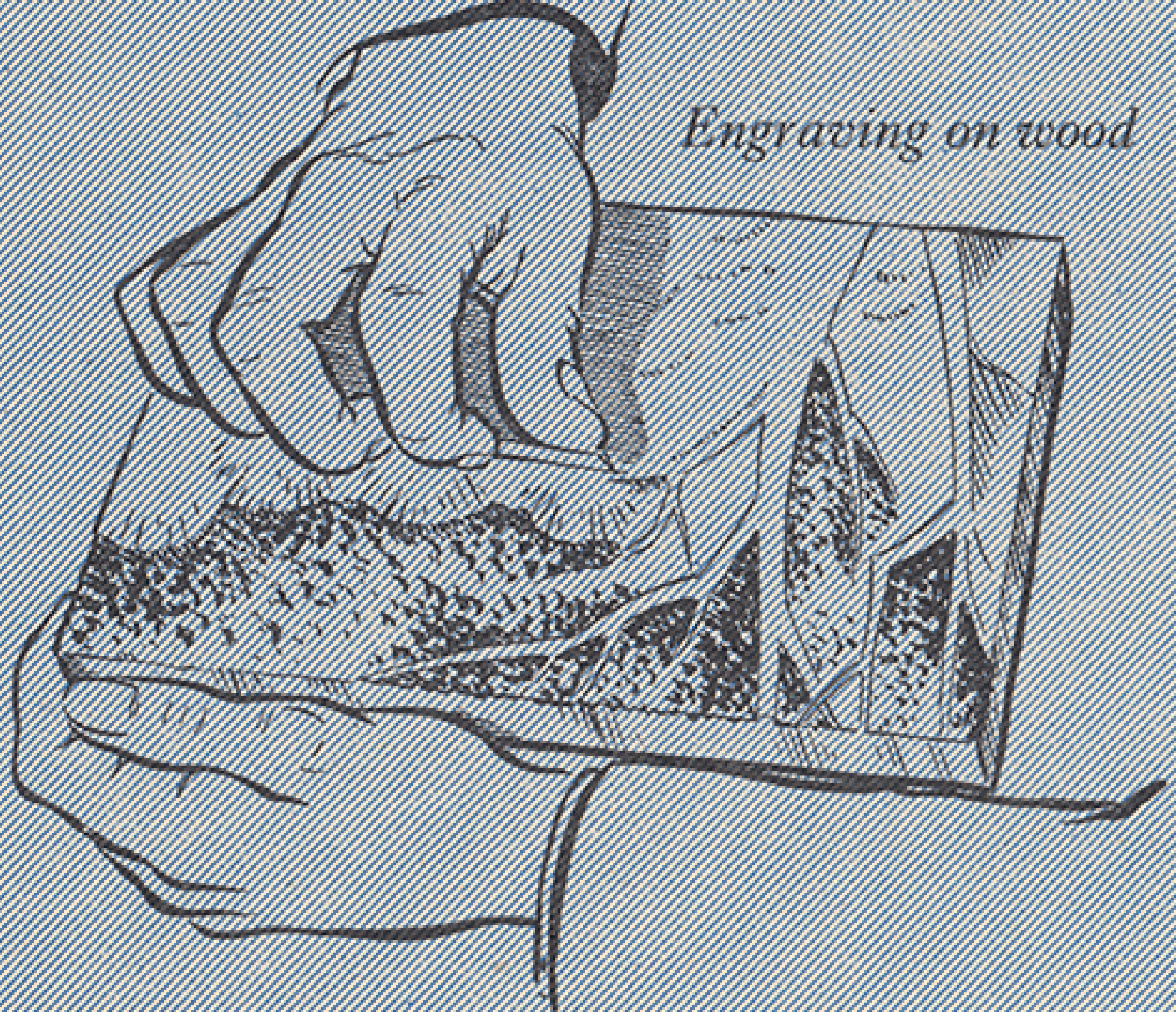
Newspaper rotary

'Make ready'

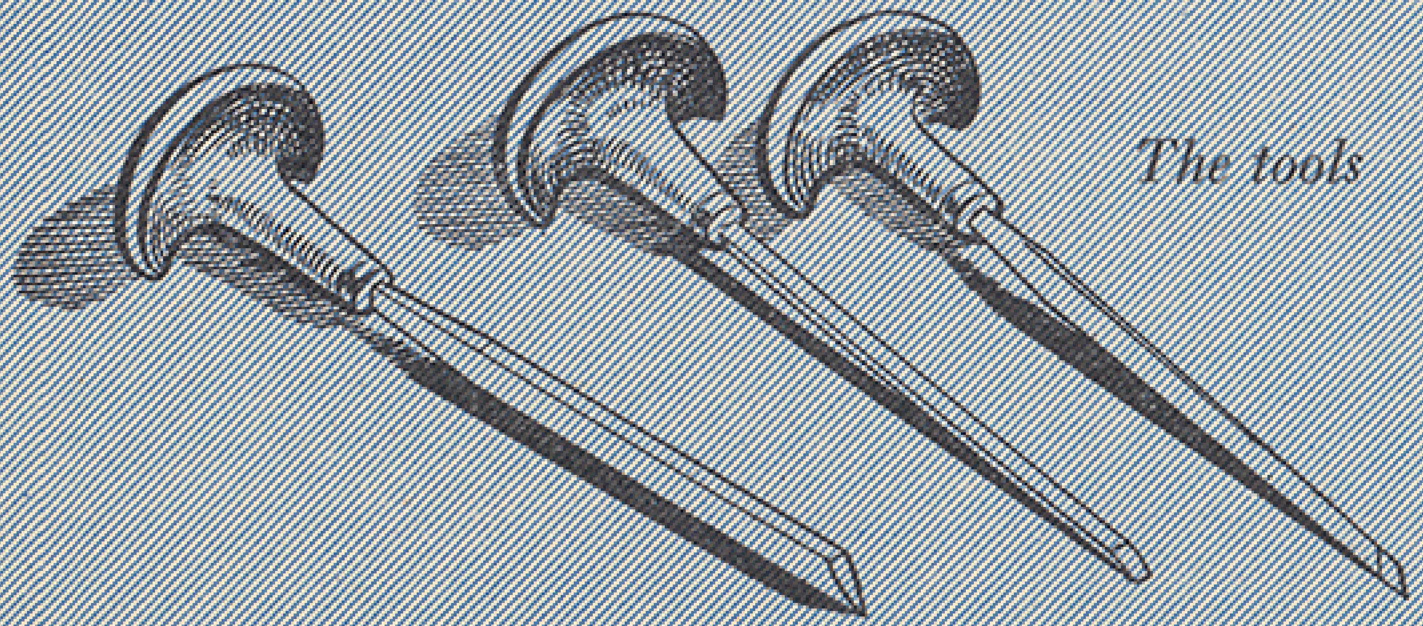

Patching and cutting away on impression cylinder covering



Metal block mounted 'type high'



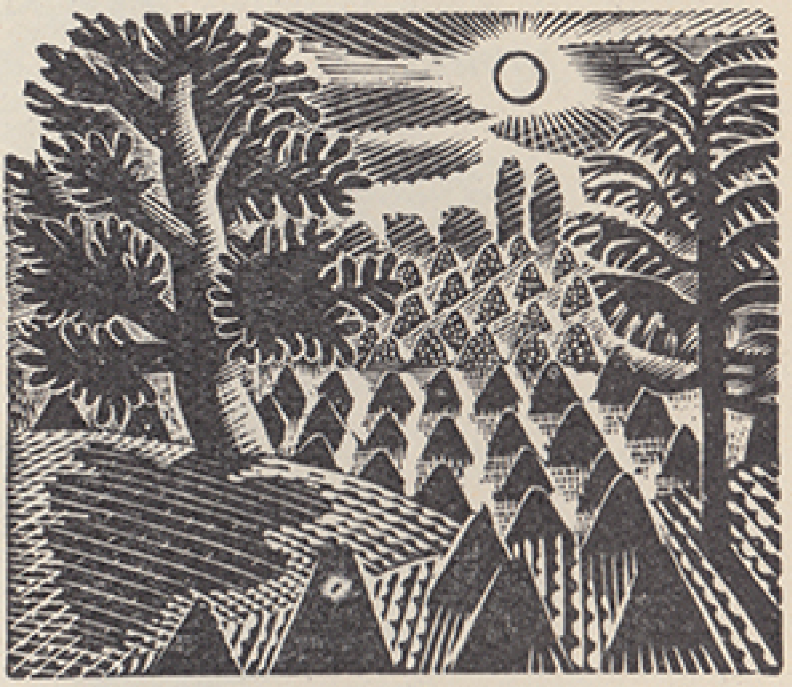
Engraving on wood



The tools

THE PRINTING OF DRAWINGS

Much of what has been said applies also to the printing of pictures. All illustrations to print with type must be represented by 'blocks' of one sort or another, but of the same nature as type. By this I mean that what is to print must stand at the same height as the type, and where white paper is to remain, the level of the block must be lower. (See drawing to the left.)

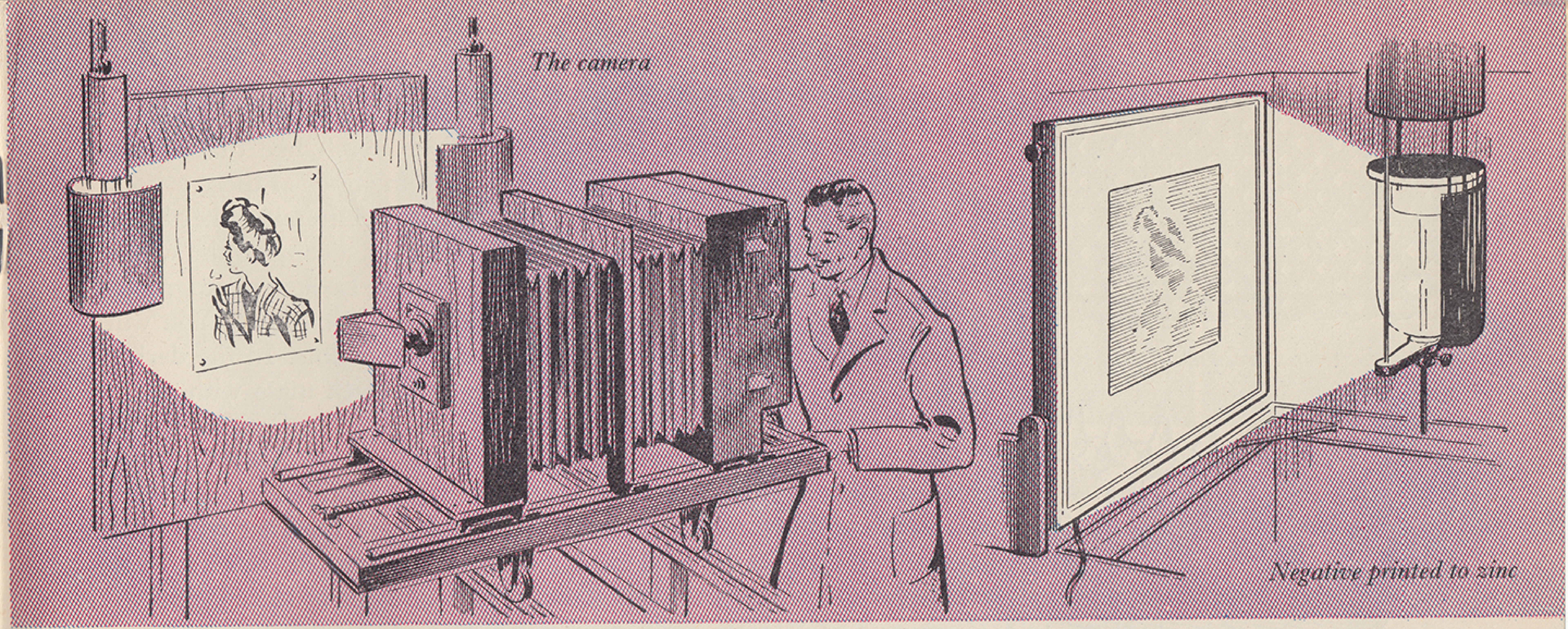


Print from a wood-engraving

Quite a number of books today are illustrated with blocks engraved on wood in the way described on page 4. Here to the left you see a block of boxwood being engraved and a few of the tools used.

THE CAMERA HELPS

But most of the drawings you see printed are from blocks made on zinc by photographic methods. They are made from drawings in indian ink on white paper. The drawing need not be the same size as the intended block, and is frequently made larger. This drawing is put up in front of a big camera and a negative is made from it, of the size which the block is to be. The prism on the front of the lens prevents the image being reversed.



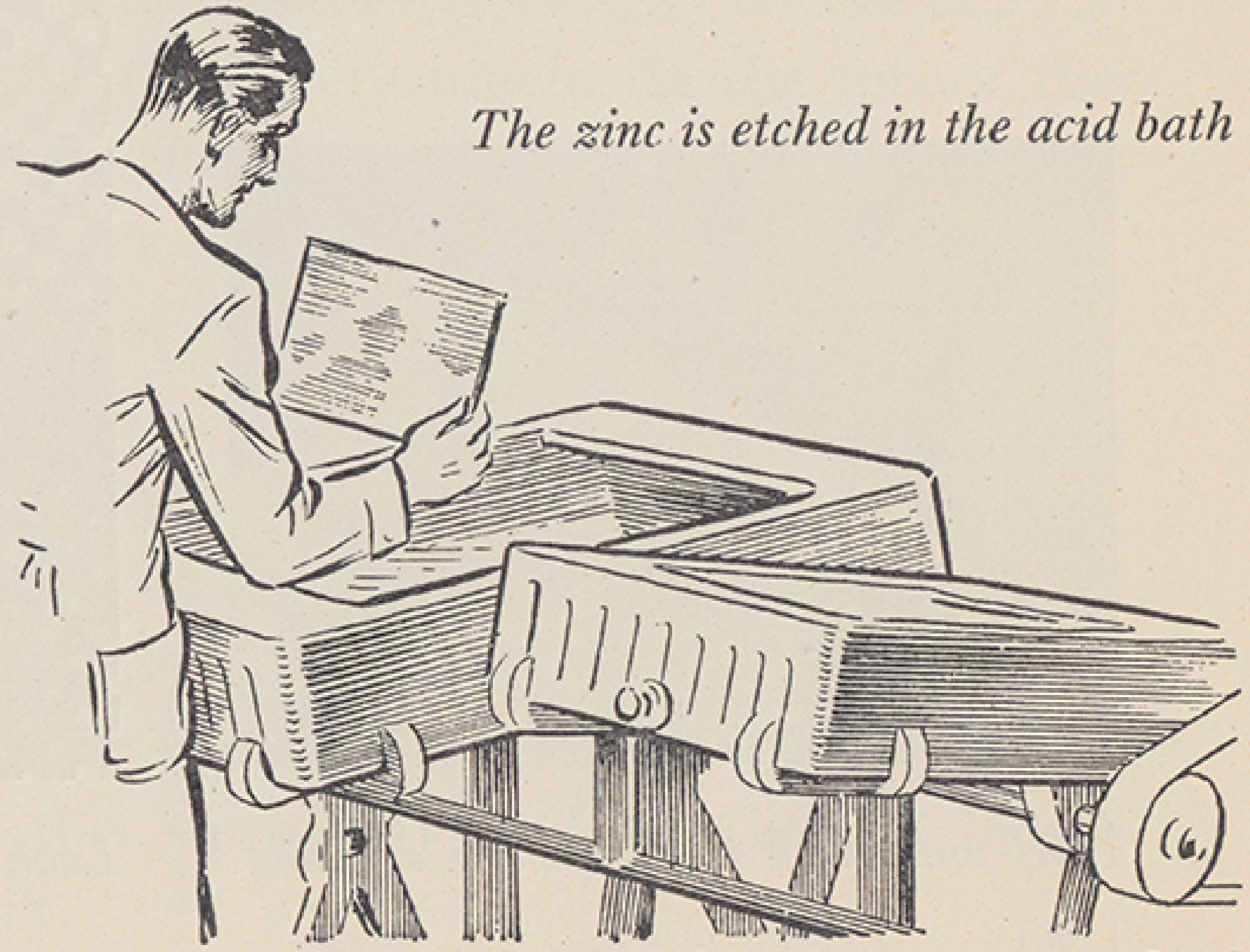
The camera

Negative printed to zinc

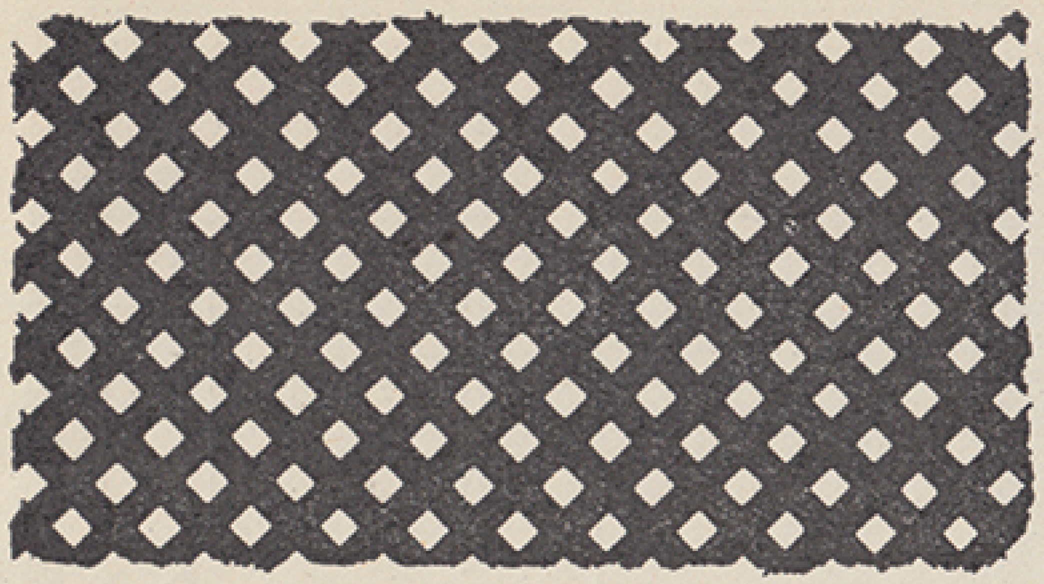
A sheet of polished zinc is coated with a photographic film and a print from the negative is made upon it. This you see to the right above.

The zinc is then treated in certain ways so that the image is protected when the whole thing is put into a bath of acid, as you see to the right. The acid eats away the metal of the background and leaves the image standing at the full height.

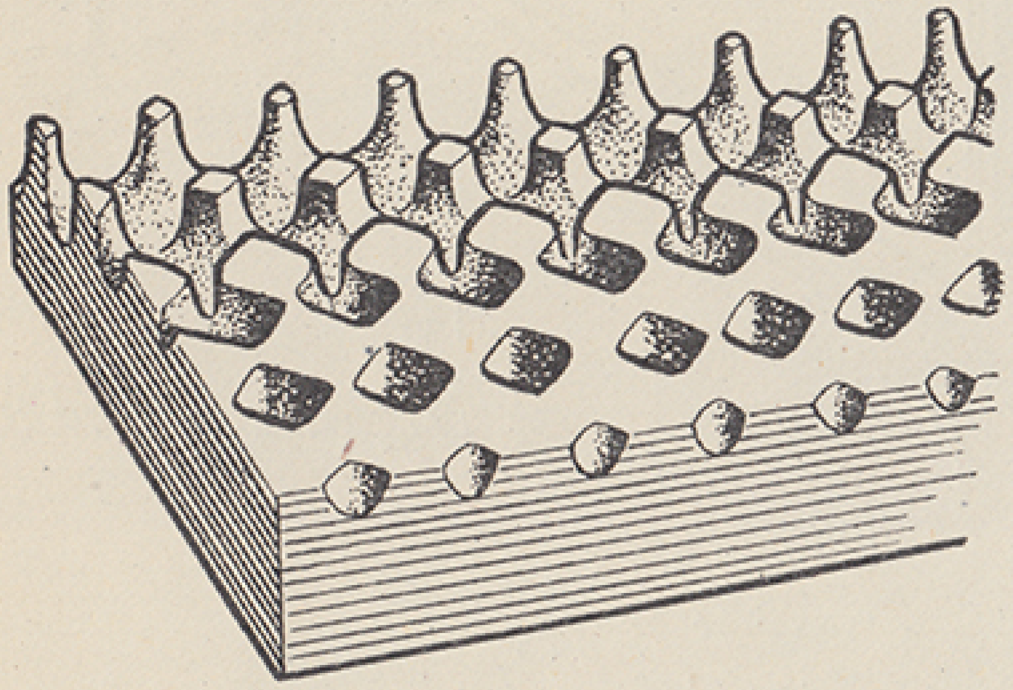
The zinc plate is then nailed to a piece of mahogany to make its 'face' equal in height to the standard height of type. This you see on the opposite page at the top. It is then ready for printing with type, and is called a 'line block'.



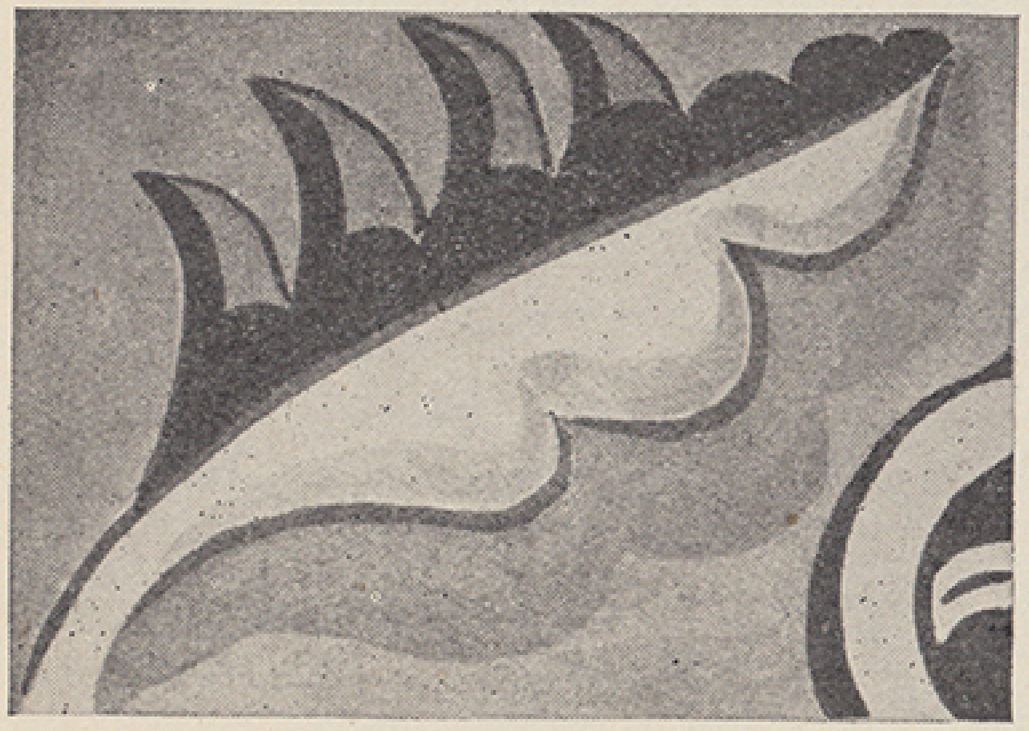
The zinc is etched in the acid bath



Part of half-tone screen much enlarged



Part of half-tone block much enlarged

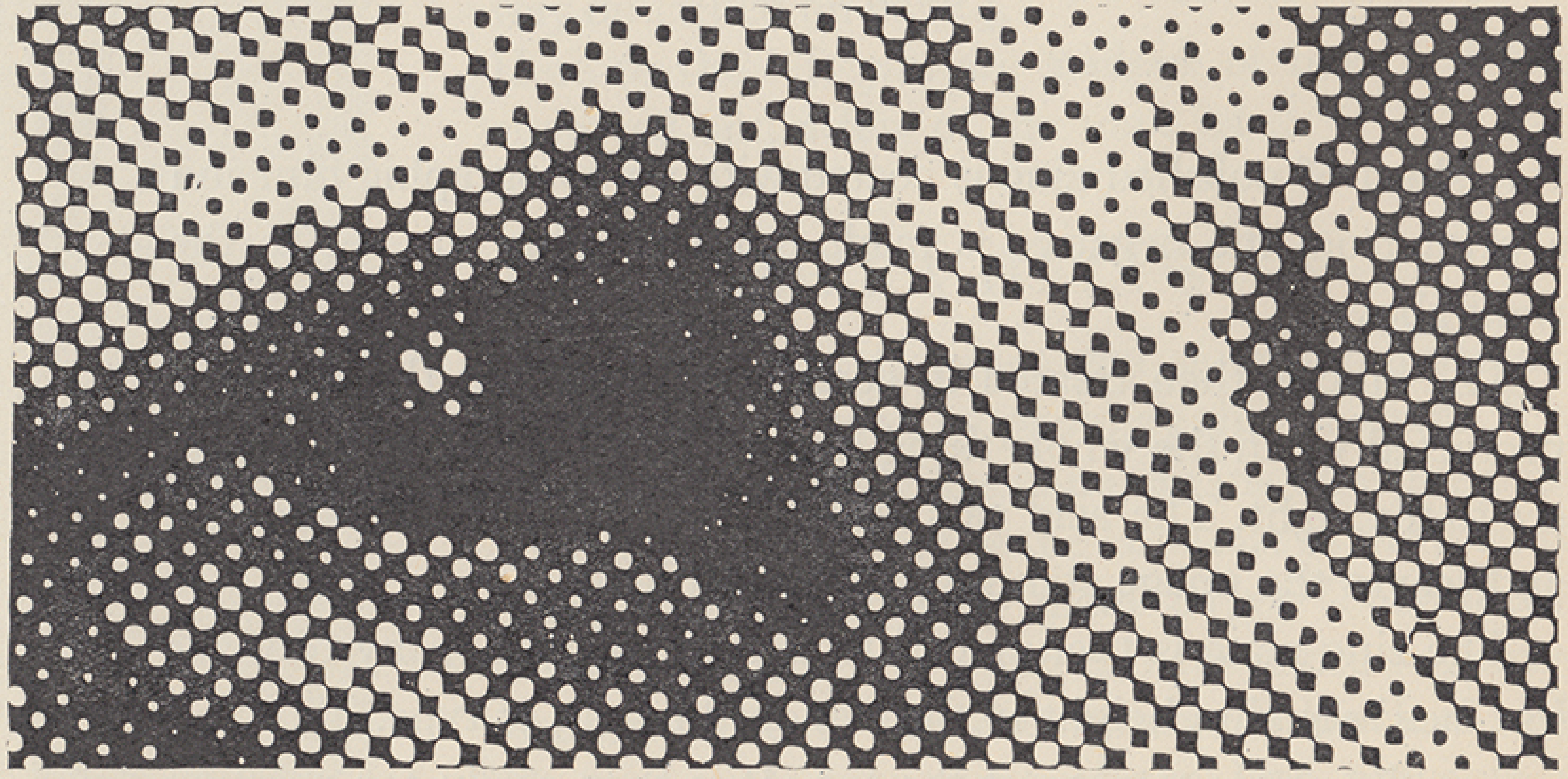


Half-tone block from a wash drawing

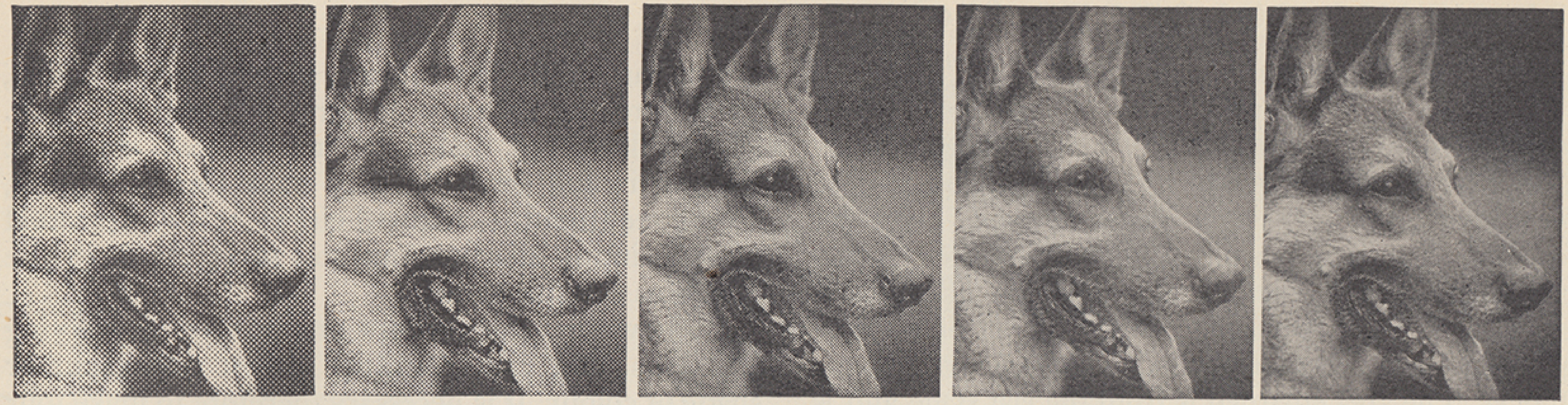
THE PRINTING OF PHOTOGRAPHS

Now supposing a photograph or a drawing in wash like that in the bottom left corner is to be printed. A block from either of these cannot be made in just the same way as a drawing that is definitely either black or white. To make a block that will reproduce such a subject, the whole surface must be broken up into dots of varying size. Look at photographs in a daily newspaper. Use a magnifying glass if you have one. You will see at once that they are made up of thousands of dots. In the darker parts they run into one another and become a black mass with white dots. All the other tones are stages between.

This breaking up is done with a 'half-tone' screen. Two sheets of glass, each having lines engraved on one surface, are filled in with black composition. When the two pieces of glass are put together with their lines at right angles, a network of black lines is formed. See above to left. Between the crossed black lines are tiny squares of clear glass.



Look at this from the other end of the room



50 *line* 65 *line* 80 *line* 100 *line* 120 *line*

Half-tone screens of varying fineness suit different papers

This screen is used in front of the photographic plate in the camera, and in effect each clear glass square becomes a sort of lens. The negative therefore takes the form of dots of varying size. From it a print is made on a sheet of copper. This, when etched and mounted on wood to type height, is called a half-tone block. You see an enlarged detail of one of these in the second drawing on the left. A print from a much-enlarged detail is also given. This appears to represent nothing when seen close to, but look at it from a distance, and you will understand how the slightest variation of tone affects the shape of the dots.

Some half-tone blocks are much finer screen than others, as you see above. Newspapers use screens with about 65 lines to the inch each way, but in finer work there may be 150 or even 200 lines to the inch. In a square inch of a half-tone block from a 150-line screen, there are 22,500 dots. Even in a newspaper block a square inch has 4,225 dots, so no wonder you do not notice them very much. At the top of this page you see the same subject reproduced with different screens.

The making of half-tone blocks is far from purely mechanical work. Much skill is needed in judging just the right exposure to give at all stages. The etching also has to be most carefully controlled, and in this retouching by hand is necessary on the negative, and also on the copper plate.

Without this work very dull and lifeless blocks would result.

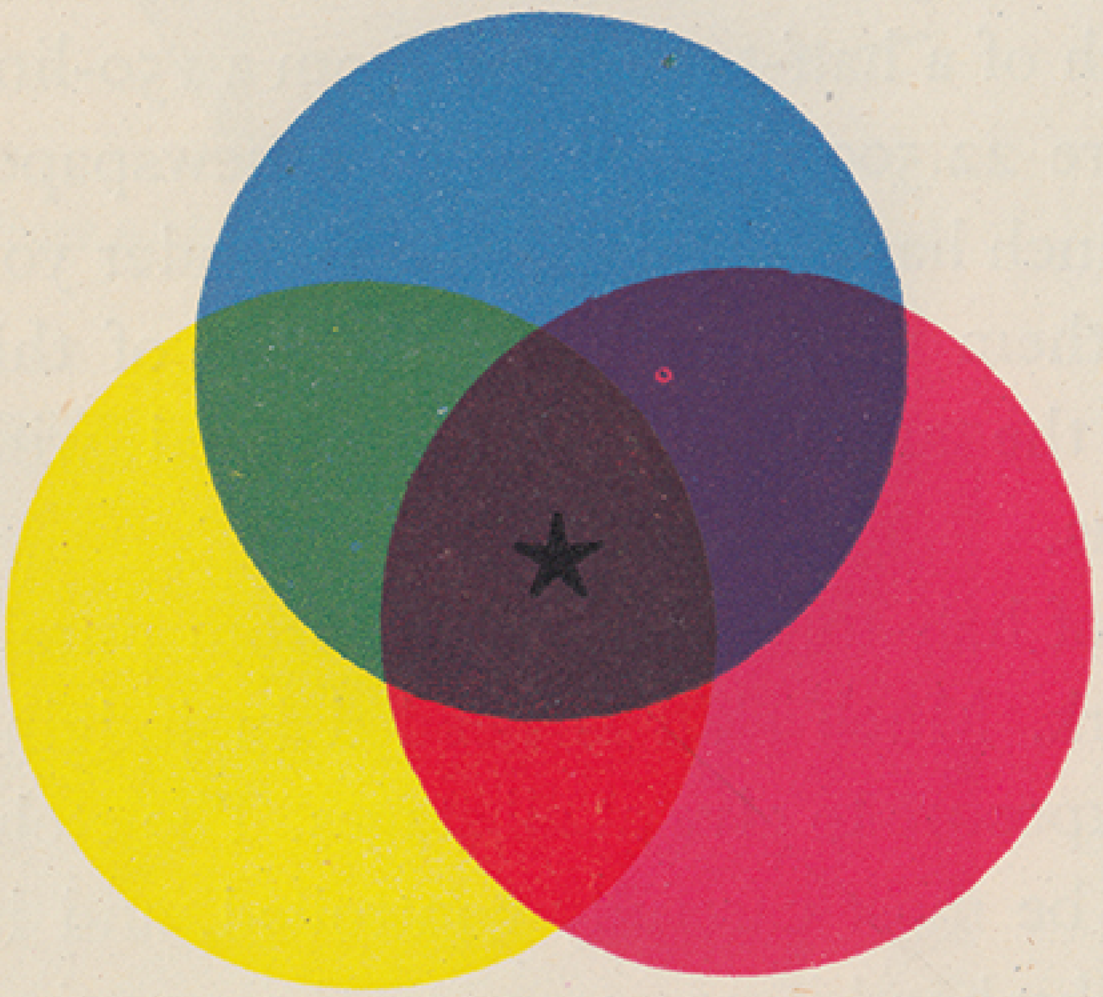
PRINTING COLOURED PICTURES

Now, how are prints made in full colours ? There are very many different processes, only some of which there is room to explain briefly here.

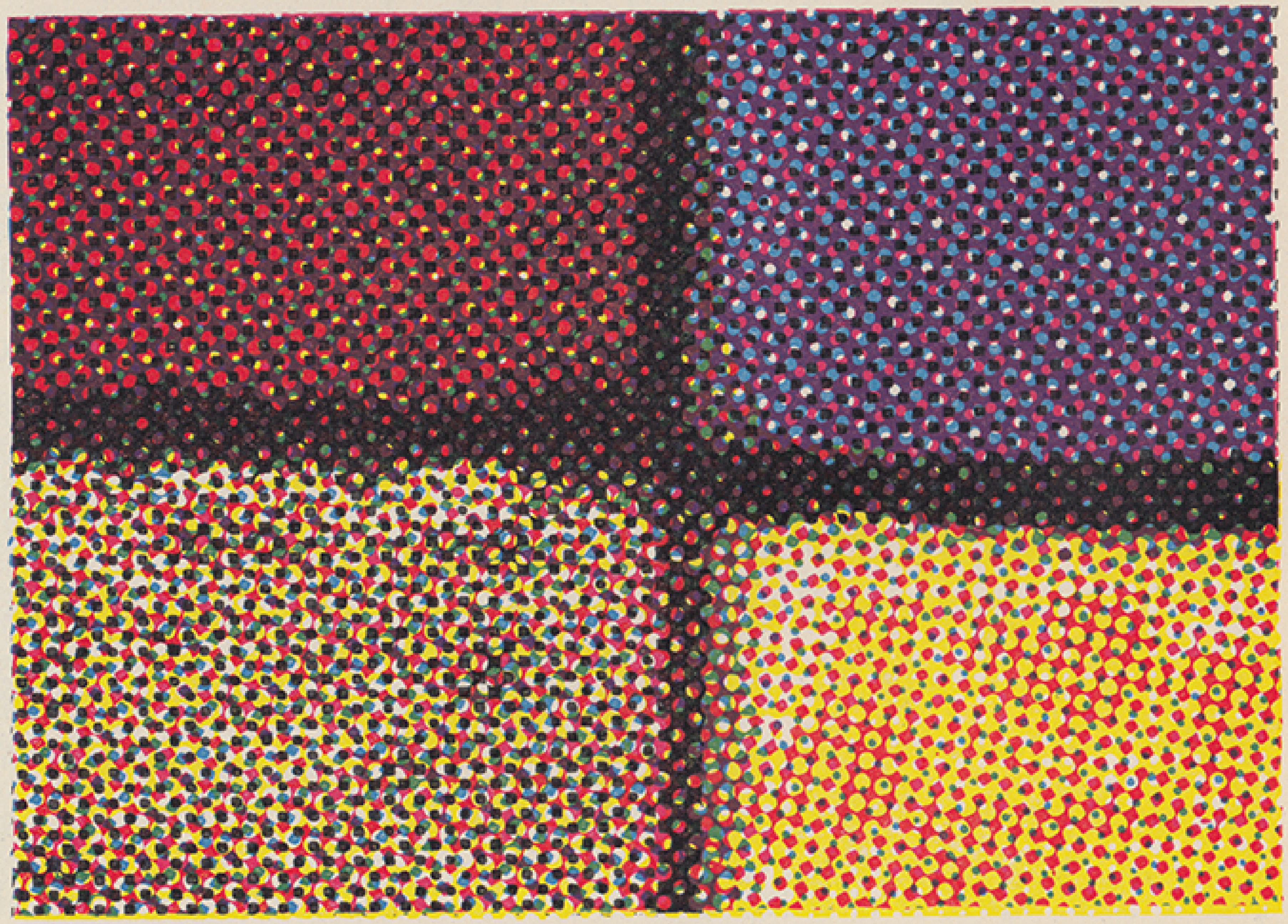
If several colours are to be used, one only can be printed at a time, whatever process is used. The sheet of paper has therefore to be put through the printing machine again for each succeeding colour. Below you see a very much-enlarged detail of a set of colours, printed from what are called 'four-colour' process blocks. The area enlarged is from the last stage and is shown within the rectangle printed on the yellow plate (see opposite page). You will see that the picture is made up of many dots in varying sizes, and that they are in three different colours, yellow, red and blue, which are the primary colours, and also in black.

If yellow, red and blue are printed over one another in full strength, they make nearly a black, as you see from the coloured circles below. An actual black printing sharpens up and gives depth to the result, as the star shows.

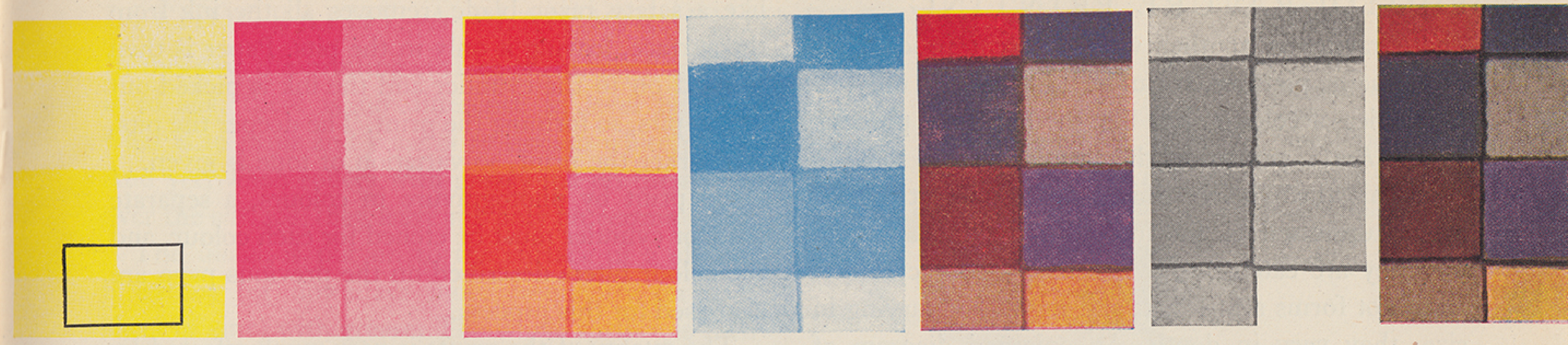
If, however, the colours are printed in varying strengths, they can reproduce almost any colour or shade of colour. It is necessary therefore to make four half-tone blocks to be printed in these four colours, but varying in strength, as required by the different parts of the original.



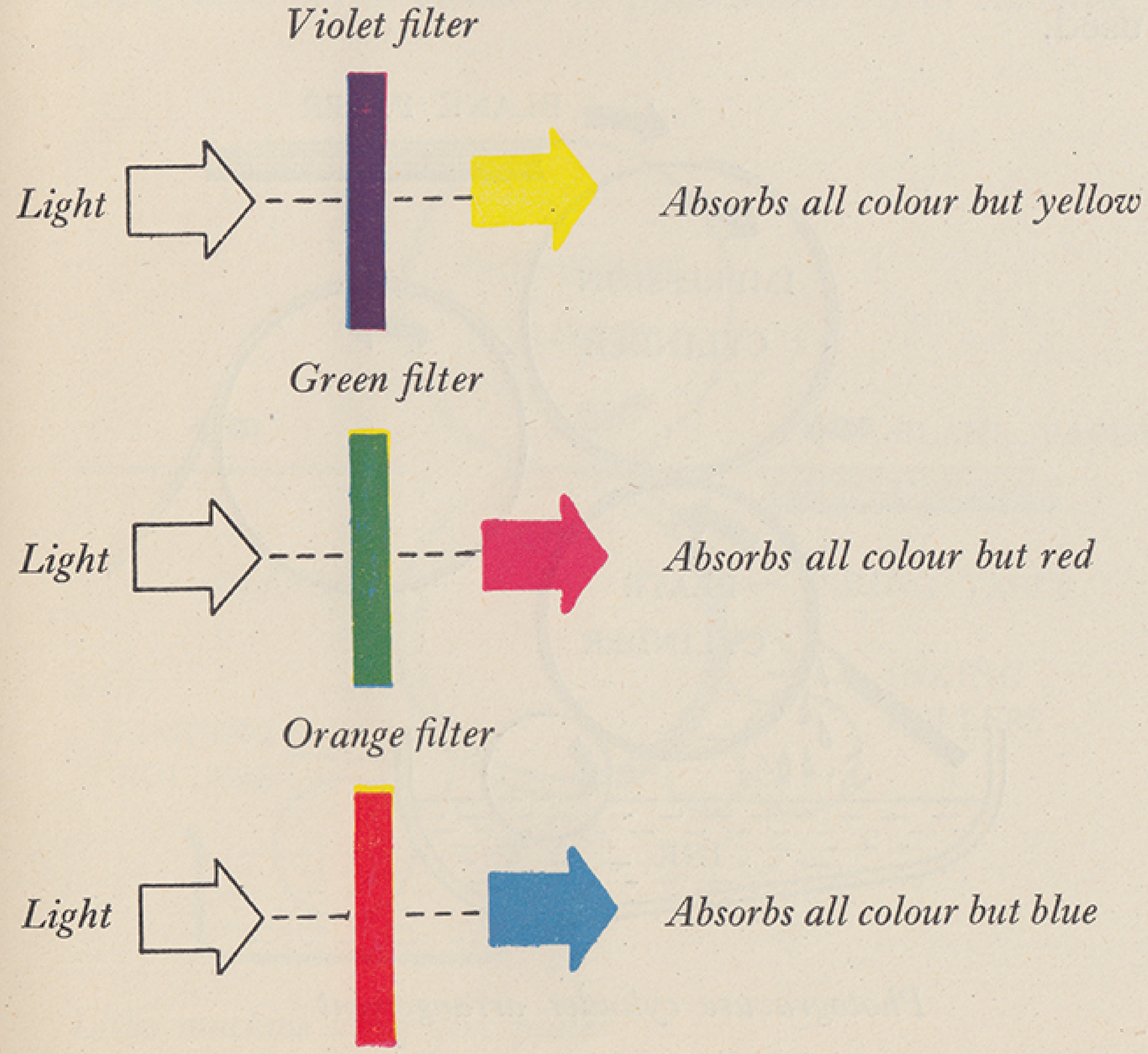
The three primary colours over one another with star in black



View this from a distance



Yellow Red 2nd Stage Blue 3rd Stage Black Last Stage


Violet filter
Light
Absorbs all colour but yellow
Green filter
Light
Absorbs all colour but red
Orange filter
Light
Absorbs all colour but blue

This sounds very difficult, and it certainly requires great skill. The process of making the blocks is very like that already described for half-tone block making. The difference is that four negatives have to be made, and for each a specially coloured glass is put behind the lens of the camera. These glasses are called 'colour filters', and they are of the complementary colours. As is explained in the diagram to the left, each of these glasses has the power to absorb two of the primary colours and allow only the third one to pass through to the photographic plate in the back of the camera. In this way the four negatives are made, and from them the four printing plates are etched.

At the top of this page you see the four colours as they are built up, one over the other, to form the picture.

PHOTOGRAVURE PRINTING

Photogravure is another very different process for reproducing pictures. It can be used in black only, or in a series of colours, just like the half-tone process. *Picture Post* is printed by this process.

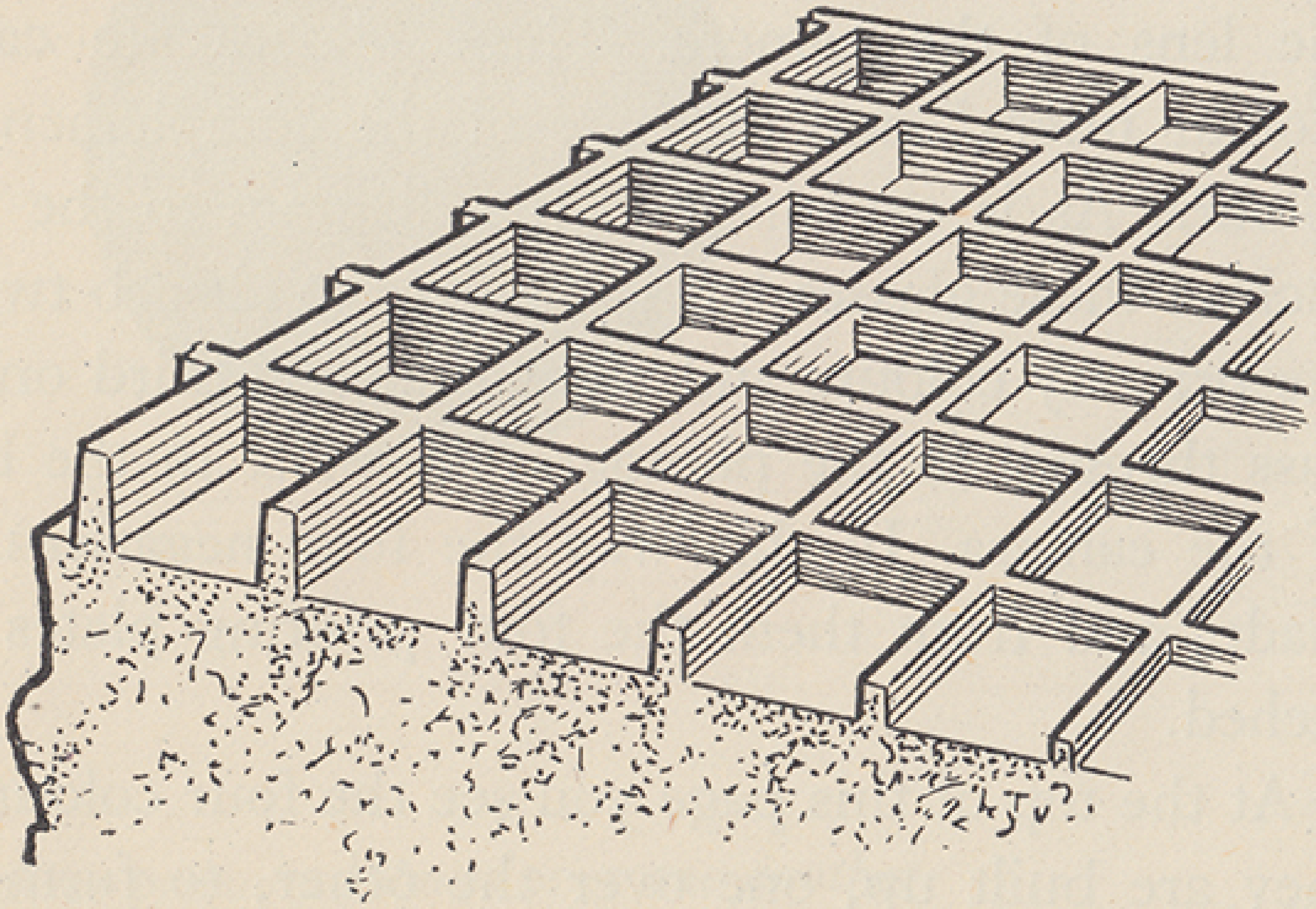
In this the whole surface of the subject is also broken up into dots. But instead of the dots standing up, they are eaten into a polished copper cylinder. Each dot forms a little pit, and instead of varying in size, they vary in depth. An enlarged diagram of part of a photogravure plate is shown below.

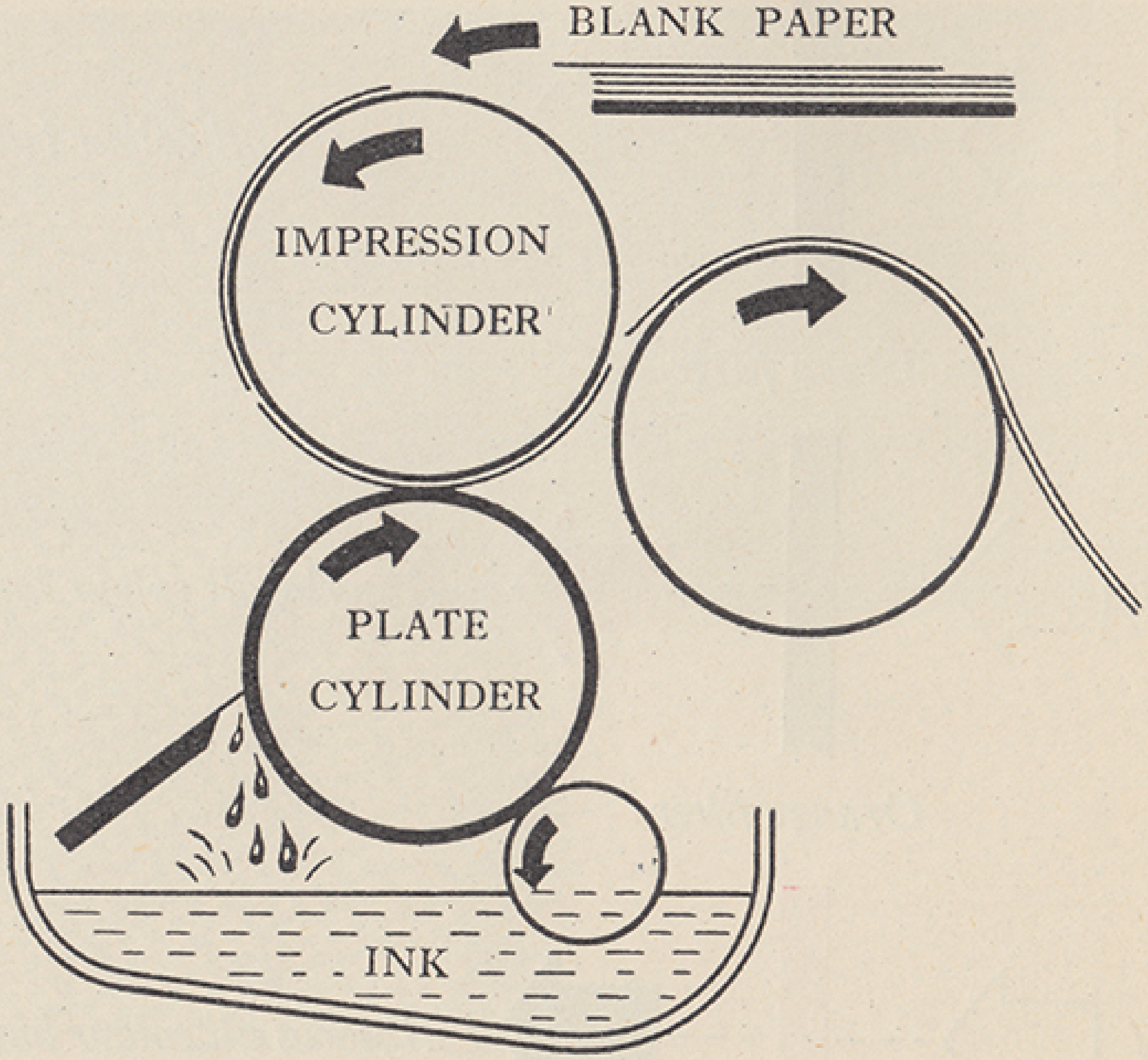
The whole surface of this cylinder has a very fluid ink flooded upon it. Afterwards a knife, rather like a safety razor blade, removes all the ink from the surface, leaving it only in the pits. Paper is then pressed on to the cylinder and the ink is picked out of the pits, so forming the print. The deeper the pits, the darker the print, so variation of tone is given.

To print by photogravure in colours, a separate plate or cylinder must be etched for each colour, and the colour filters described on the previous page are also used for this process.

The quality of the prints is very much affected by the skill of the retoucher and by the choice of paper used.

Enlarged detail of photogravure pits



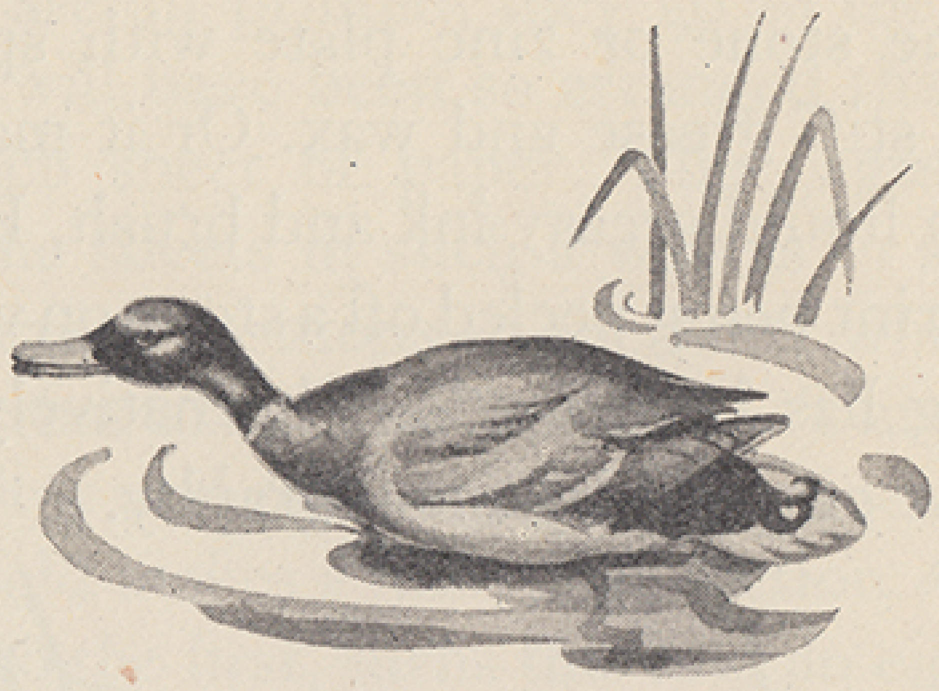


Photogravure cylinder arrangement

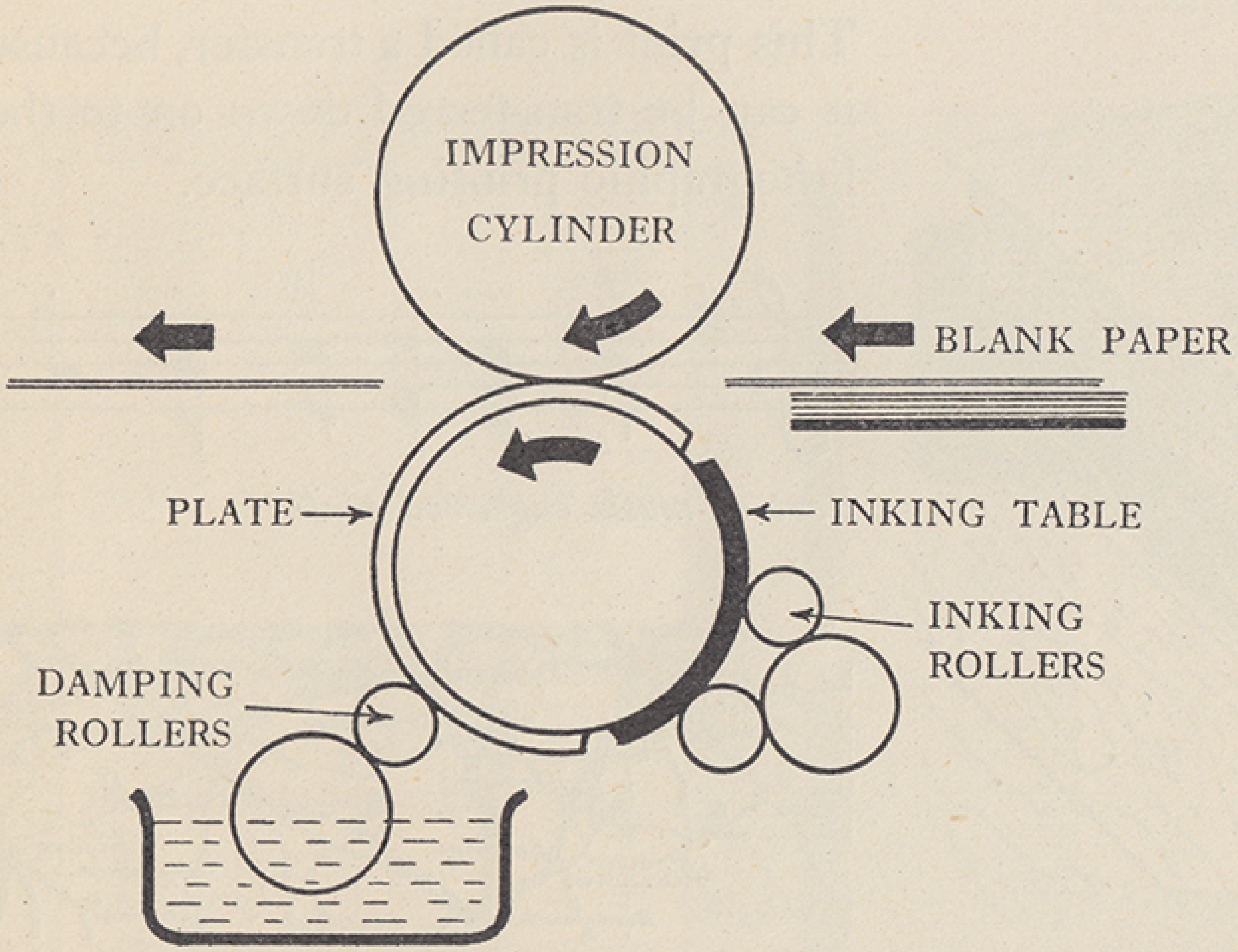
LITHOGRAPHY—A PLANOGRAPHIC PROCESS

In this case the printing surface is entirely flat. That is to say, there is no difference in level between what is to print and what is to remain white paper. And yet, when rollers with greasy ink on them pass over the surface, they leave ink only on certain parts.

The image is put on to the surface of a slab of limestone (or nowadays more frequently on to a sheet of zinc) with grease. The whole surface is then damped. But the moisture will only remain where the grease is not already in possession. After that the surface is alternately damped and inked by two sets of rollers, each set leaving behind either moisture or greasy ink on the respective parts of the surface. Then paper is pressed on the whole surface by a cylinder, and the paper picks up the ink. If a zinc plate is used in place of stone, it can be clamped to the cylinder of a rotary machine. Some idea of this is shown in the diagram to the left.



To understand this process, you must remember that grease and water will not mix. Water runs off a duck's back because the feathers are kept greasy.



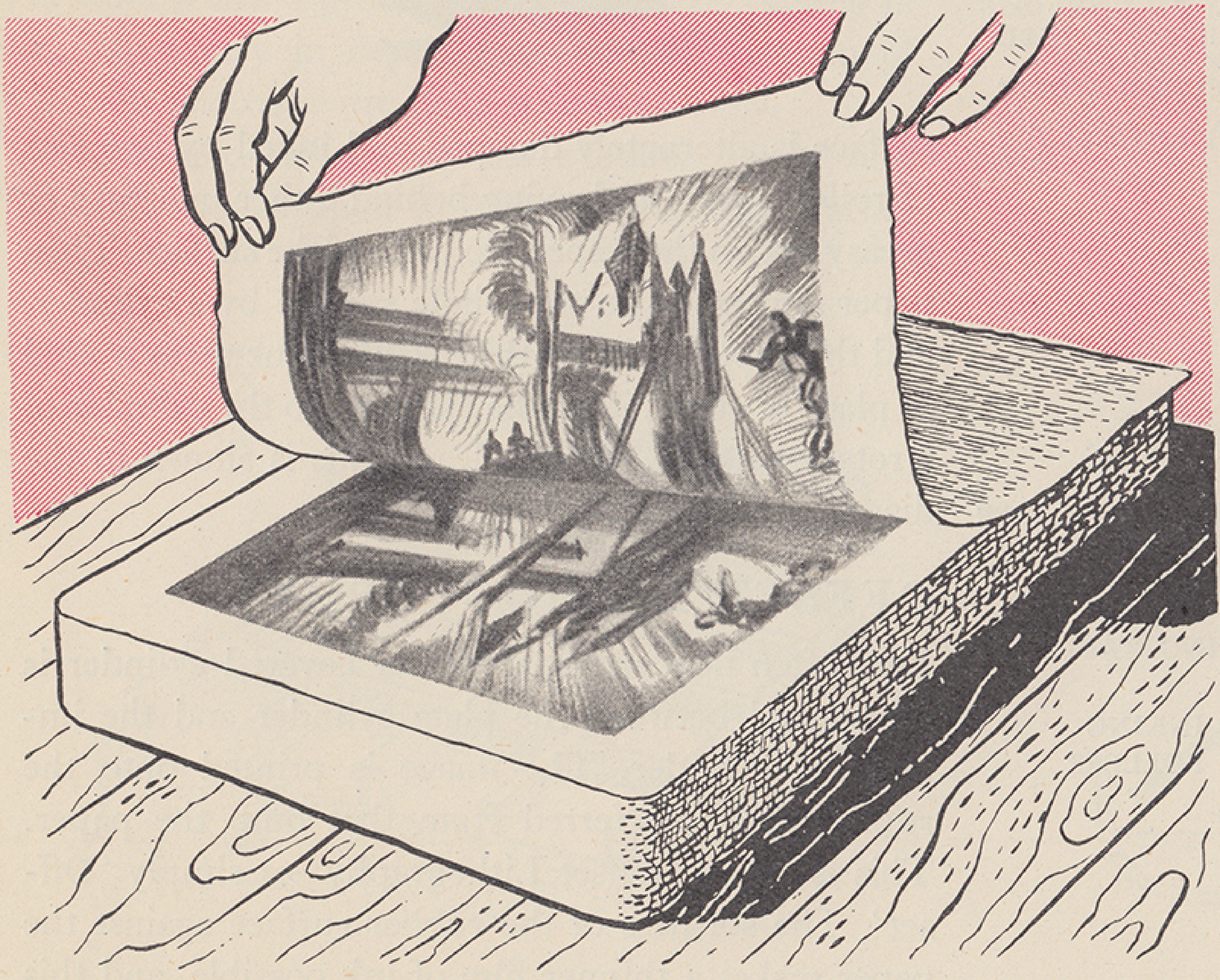
Litho machine using zinc plates

OFFSET LITHOGRAPHY

Very often now an india-rubber covered cylinder is introduced between the plate cylinder and the impression cylinder. The image is printed onto the rubber and transferred from that onto the paper. This is called 'Offset Lithography' or simply 'Offset'. The softness of the rubber surface against the paper makes a thinner film of ink possible, and this results in very sharp and clear printing.

MORE ABOUT LITHOGRAPHY AND ENGRAVING

The image to be printed may be drawn by an artist directly on to the stone or zinc plate with special crayons made of stiff grease and wax. Or it may be painted on with a liquid greasy ink and brush. Below you see a paper print being peeled off a stone on which a crayon drawing has been made. Alternatively the image may be put on plate by photography.



Drawing on stone with print on paper

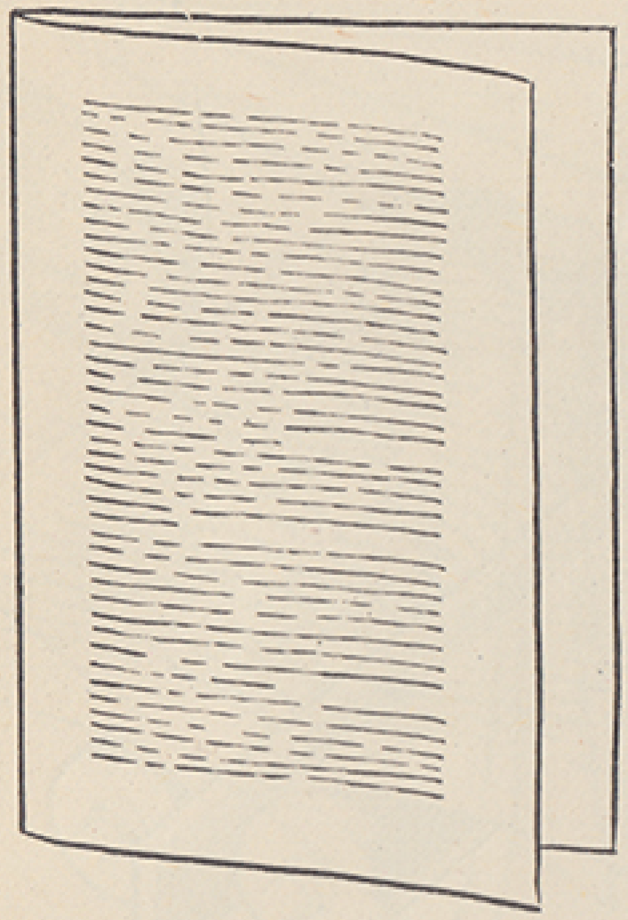
Ordnance survey maps and music are printed by this process, but in both these cases the original work is done on a flat plate of copper or pewter. The lines and characters are sunk into the plates by engraving or punching.

The recesses in the plate are then filled with stiff greasy ink by rubbing it all over the surface. Spare ink is then entirely removed from the surface by scraping and wiping. After that, a piece of soft paper is pressed upon the plate in a sort of mangle, and the ink is picked out of the recesses. This print is called a transfer, because it can be transferred down on to the lithographic printing surface.

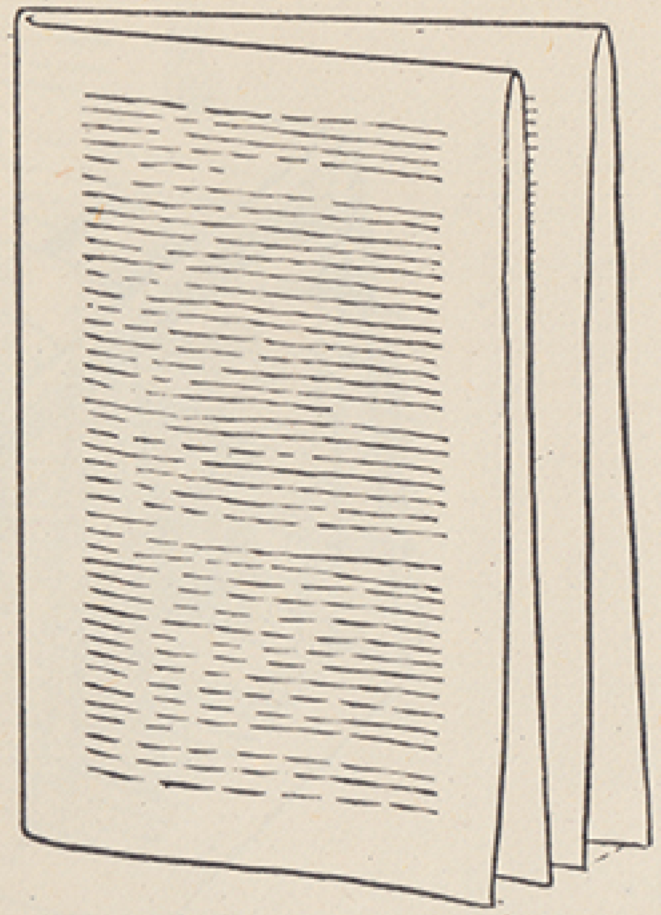
Part of music engraved plate

Detail from engraved map

FOLDING PRINTED SHEETS TO FORM A BOOK



4 *pages*

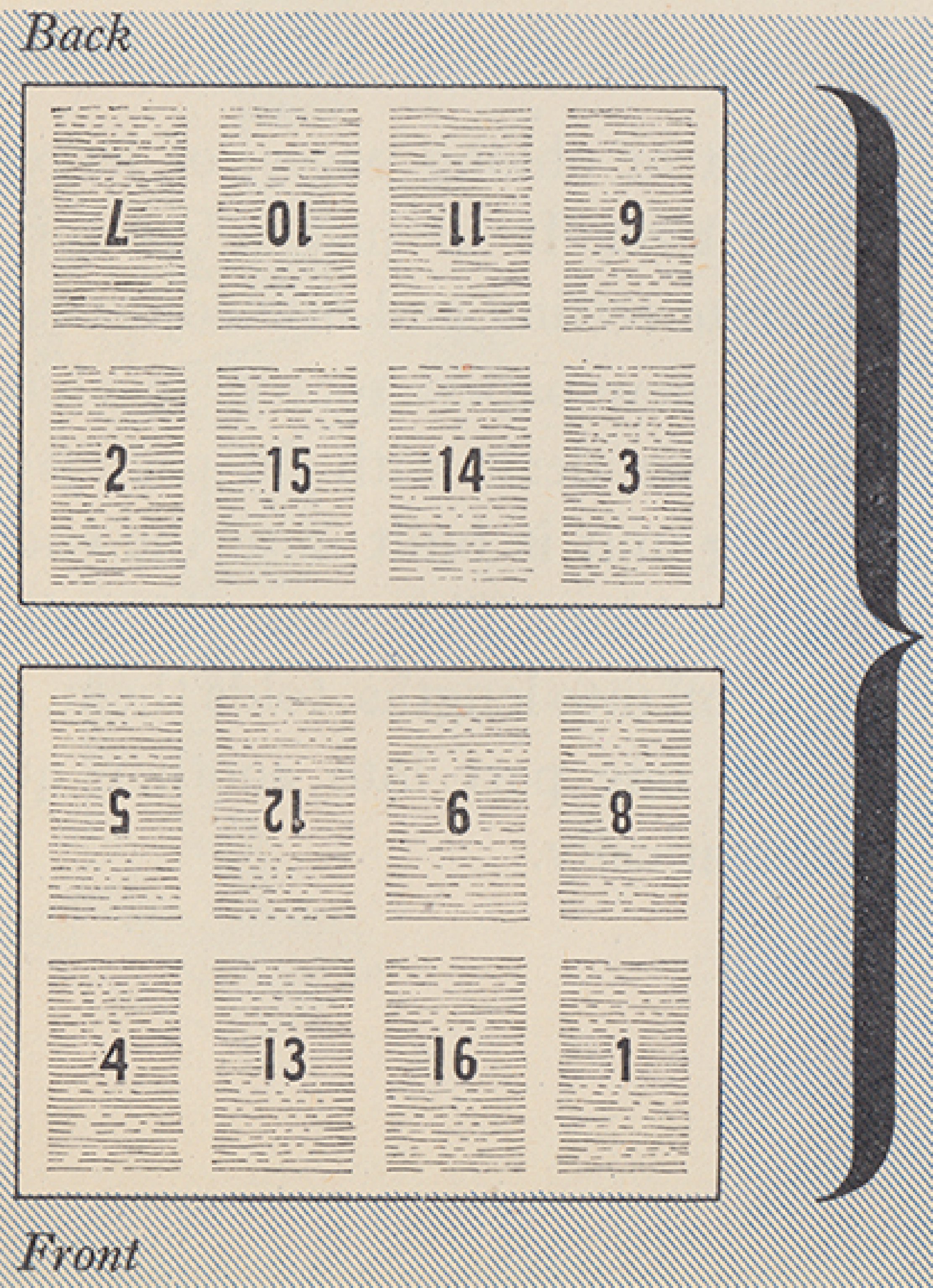


8 *pages*

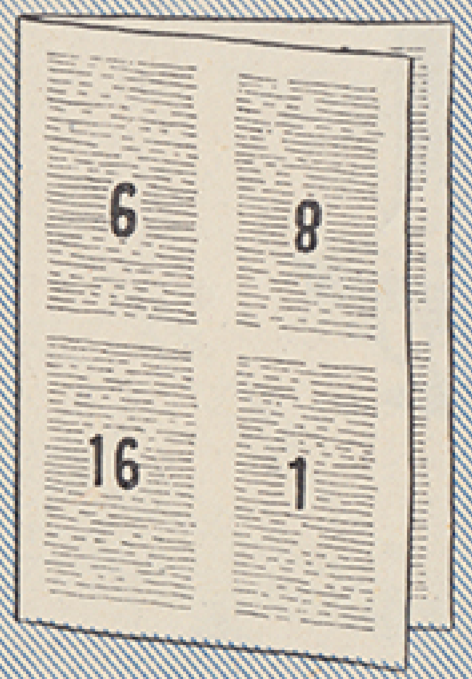
When the sheets of paper that make up a book and its illustrations are all printed, they go to the binding department. They will have been so arranged that there are many pages on each sheet of paper. The pages will have been printed on the sheets in such a way as to allow them to fall into their correct positions in the book when the sheets are folded into what are called 'sections'. This is shown in the diagrams below and on the following pages.

The first fold makes a four-page section. One more fold at right angles to the first, turns this into an eight-page section. Folded again a third time, it becomes a sixteen-page section.

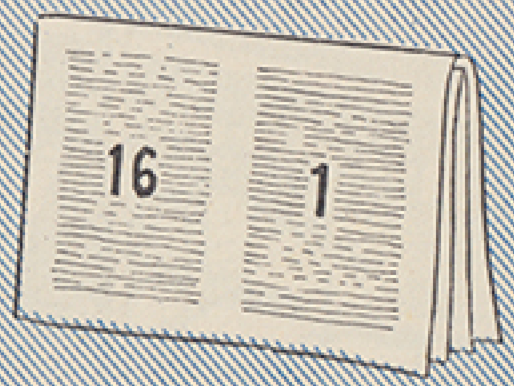
If you fold up a clean piece of paper like this, and then number all its pages and open it out, you will see how complicated is the arrangement on the flat sheet.



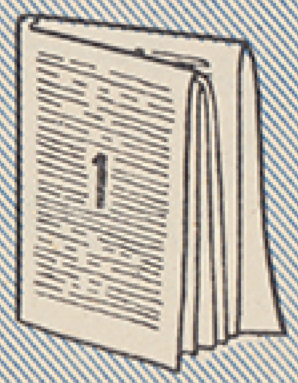
First fold



Second fold



Third fold



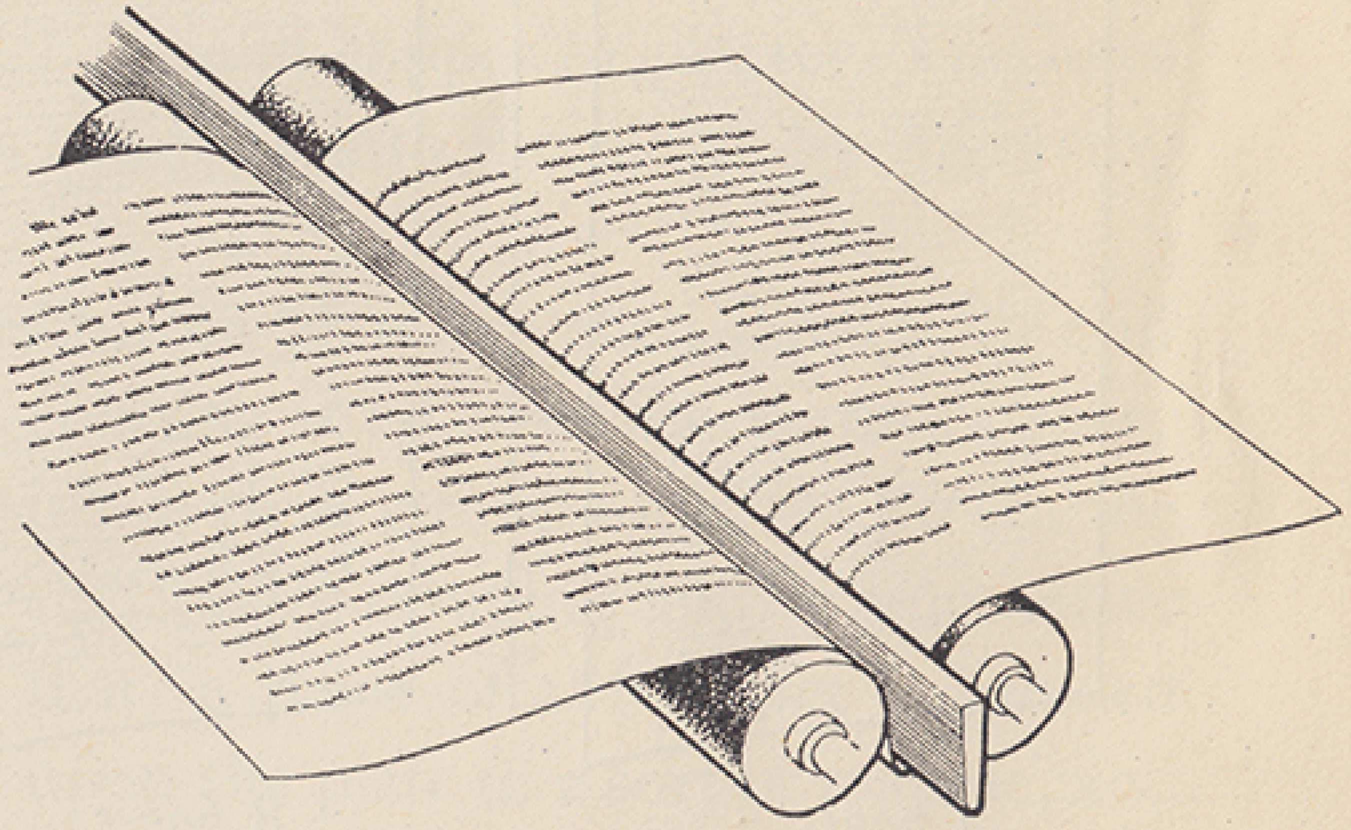
FOLDING BY MACHINERY

The folding may be done by hand if the quantity is small. It is more often done by machine. The sheets are fed into the folding machine at a great speed, and are guided on tapes and rollers. As each fold is to be made, the sheet is stopped in position, and a blunt knife comes down and makes the fold, pushing the middle of the sheet between two steel rollers.

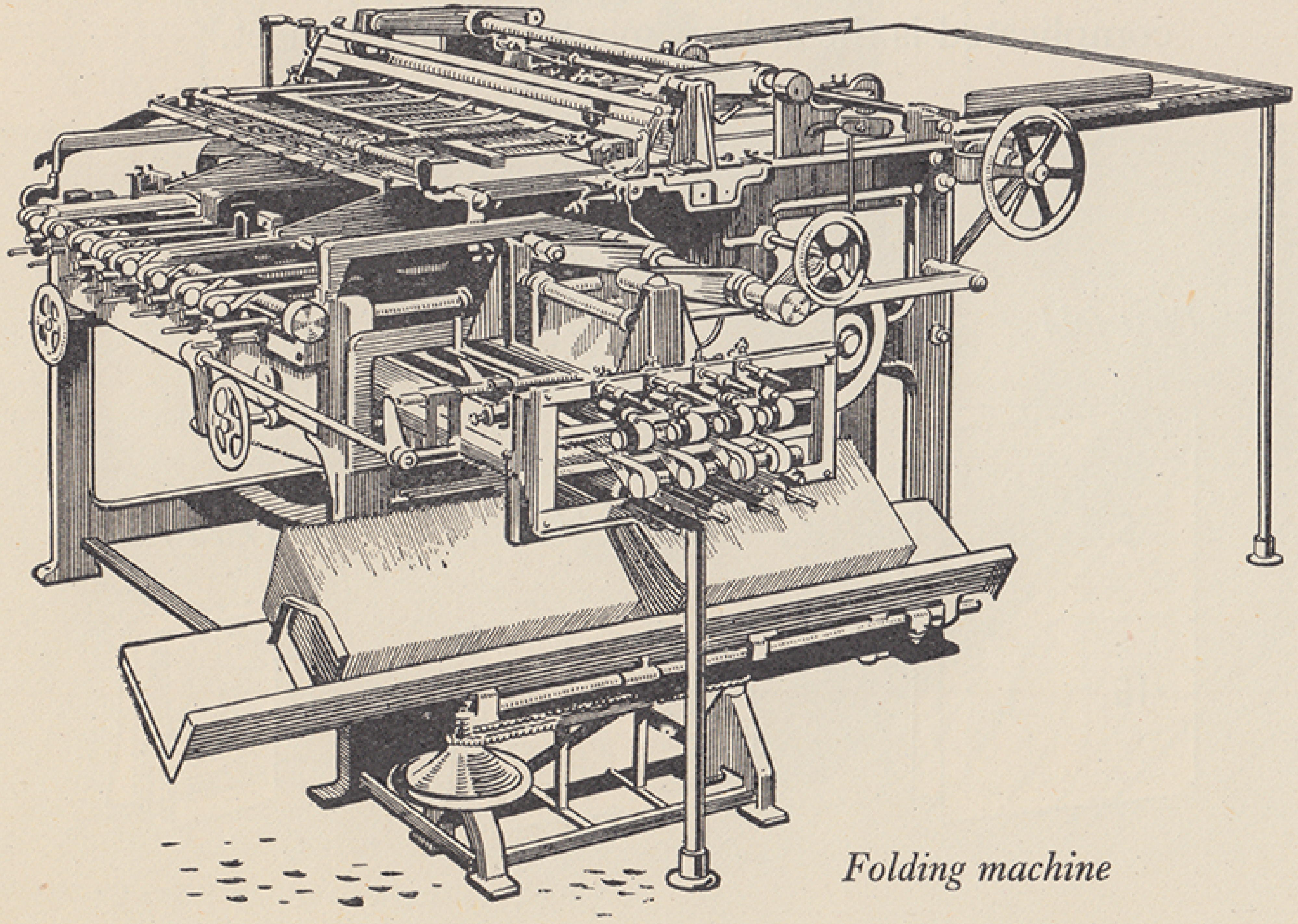
The once-folded sheet travels on till it is stopped again in the second position, and another knife pushes it between another pair of rollers.

These machines can be adjusted to make all sorts of special folds for leaflets such as you often see. They can produce upright or oblong pages, of large or small size. It is just a matter of accurate setting and fine adjustment.

On newspaper rotary machines, which we dealt with on page 15, a folding unit is built in at the end of the machine. This cuts the roll of paper off into lengths, folds them, and inserts one part into another quite automatically.

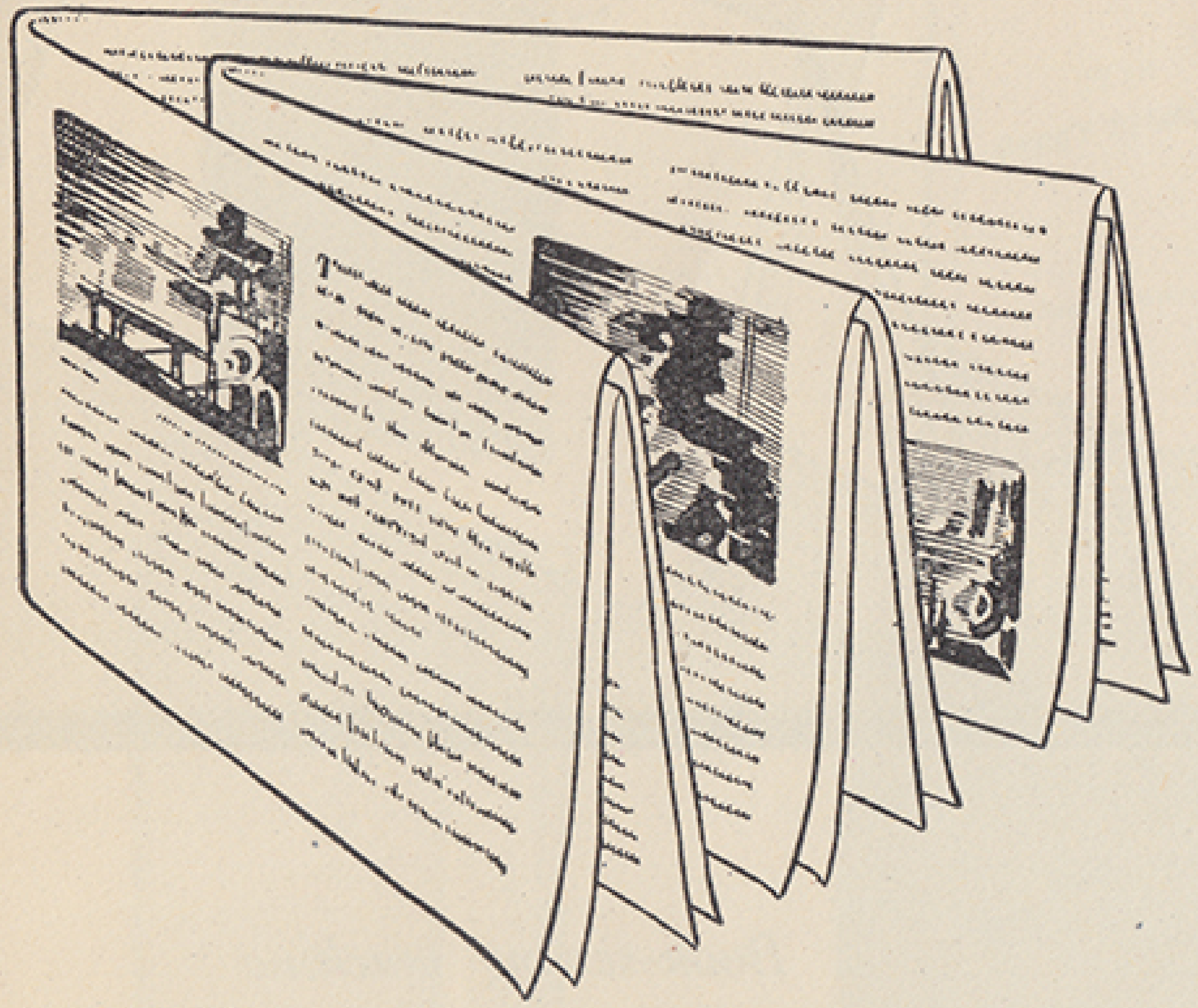


Blade and roller action



Folding machine

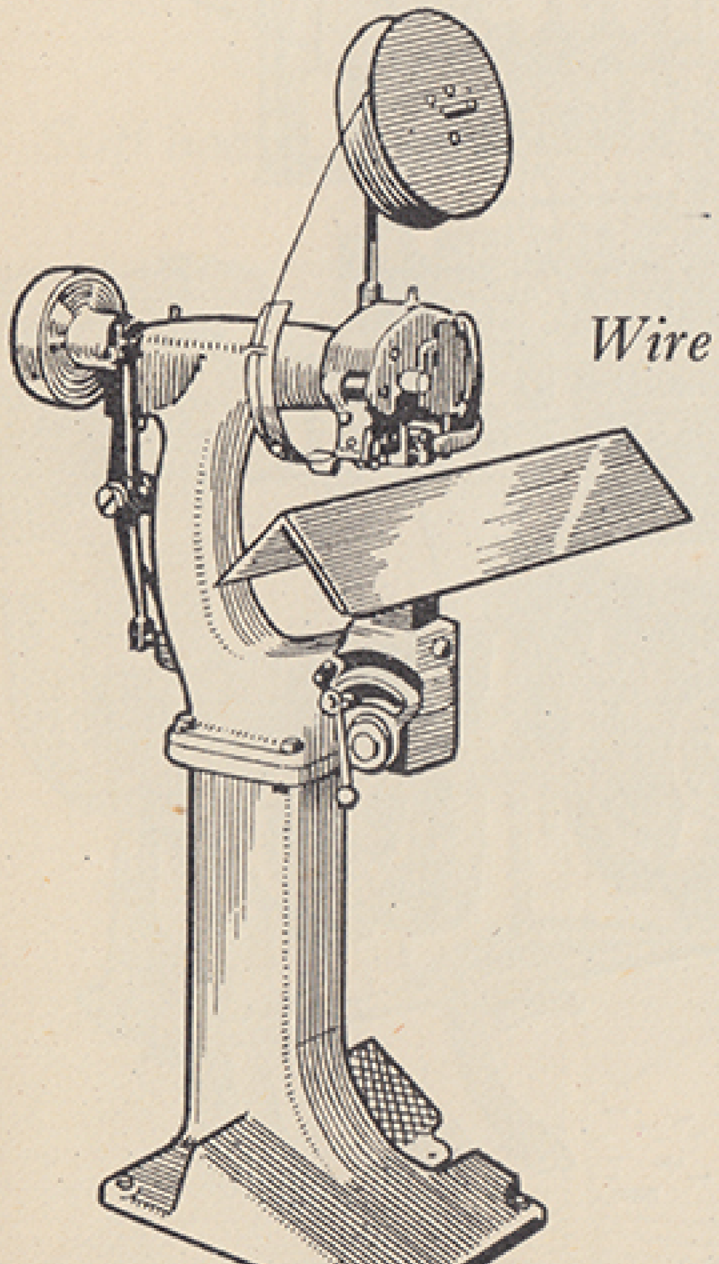
STITCHING THE SHEETS TOGETHER BY MACHINE



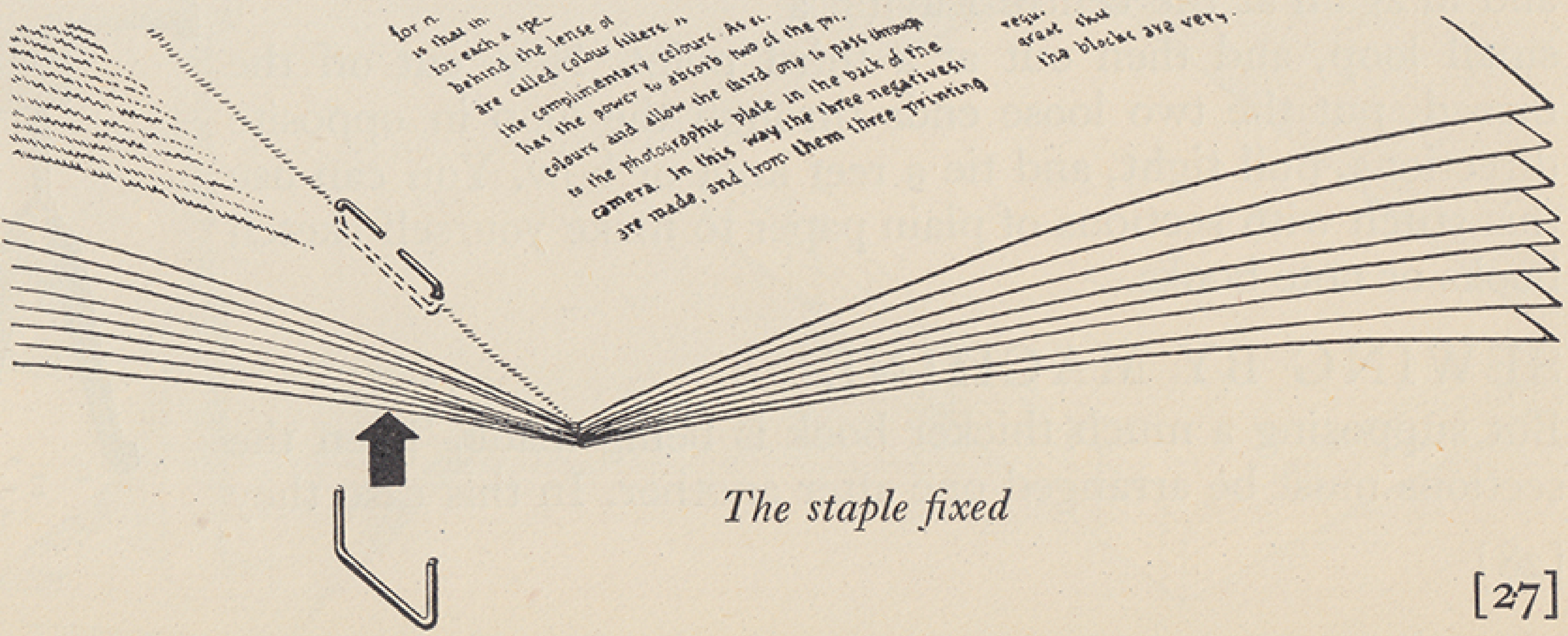
Sections put inside one another

After all folding is done, the various sheets, which have now become 'sections', are gathered up in order, so that they make the complete work. Two sections may be placed one inside the other, as seen at the left, or a section may be placed inside a cover of stout paper. These are then fastened in the simplest way by the 'stapling' machine. This is a small machine which cuts a length of wire from a reel, bends it into a staple, and drives it through the fold, turning its ends in at the same time. You see the machine and also a wire staple in use at the foot of this page.

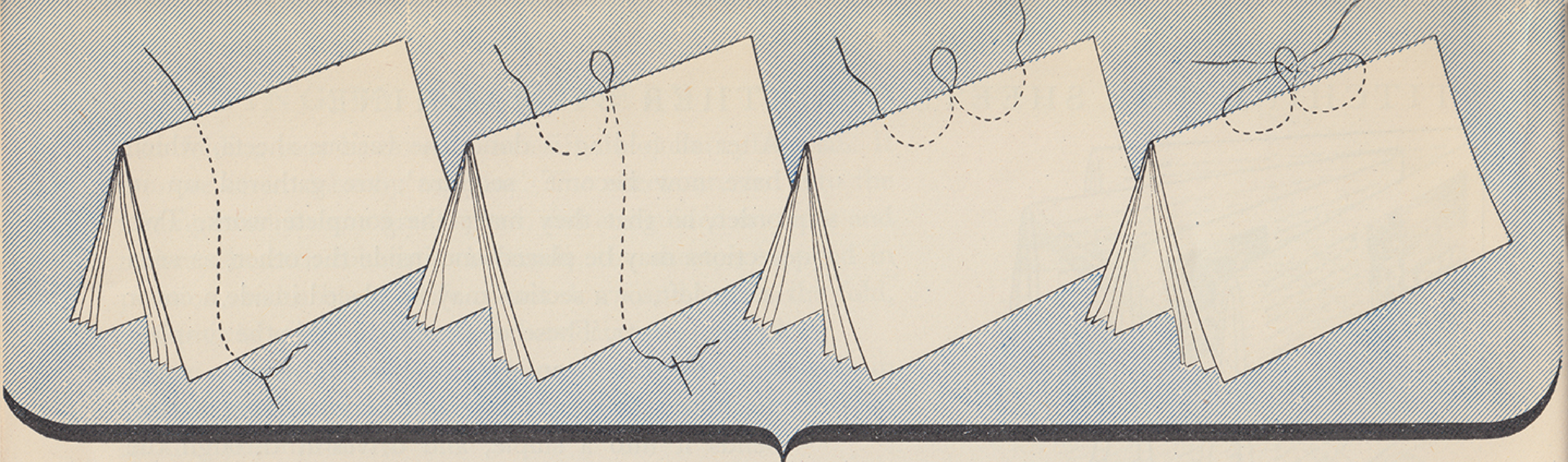
There is another machine which does this same sort of fastening, but with needles and thread. It is called a 'stitcher'. Three needles pass through the back of the fold at the same time, and carry the thread with them. The stitch is then completed and the knot tied mechanically in a moment.



Wire stapling machine



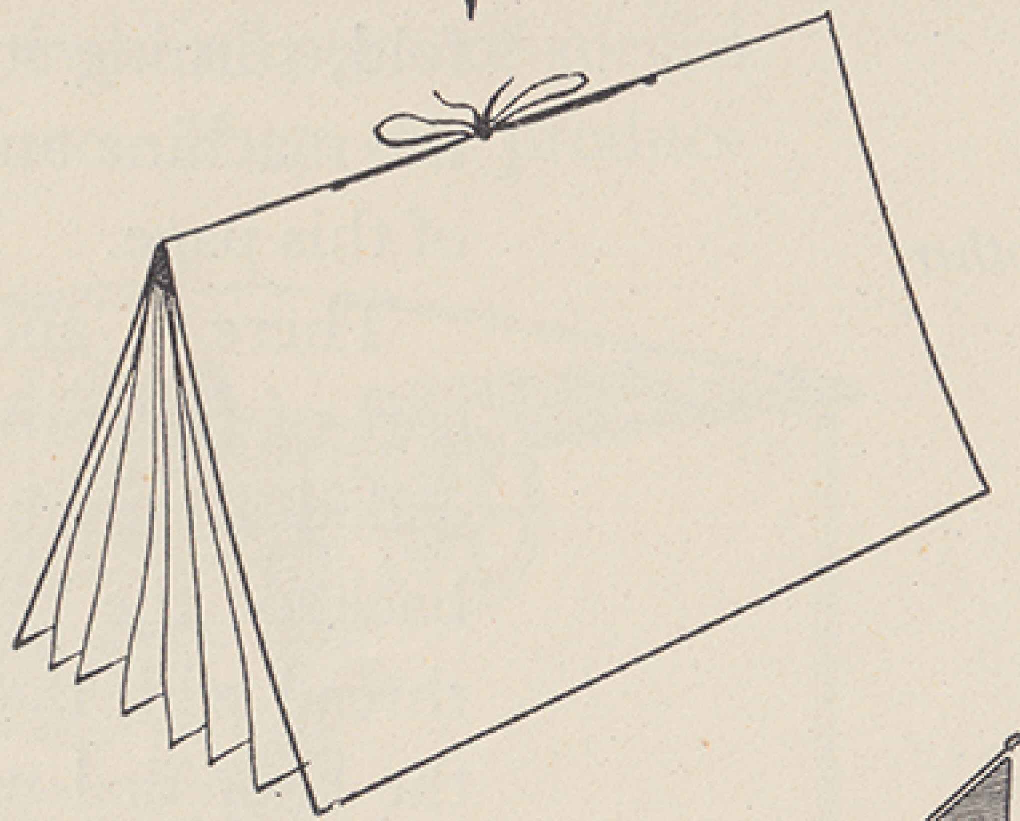
The staple fixed



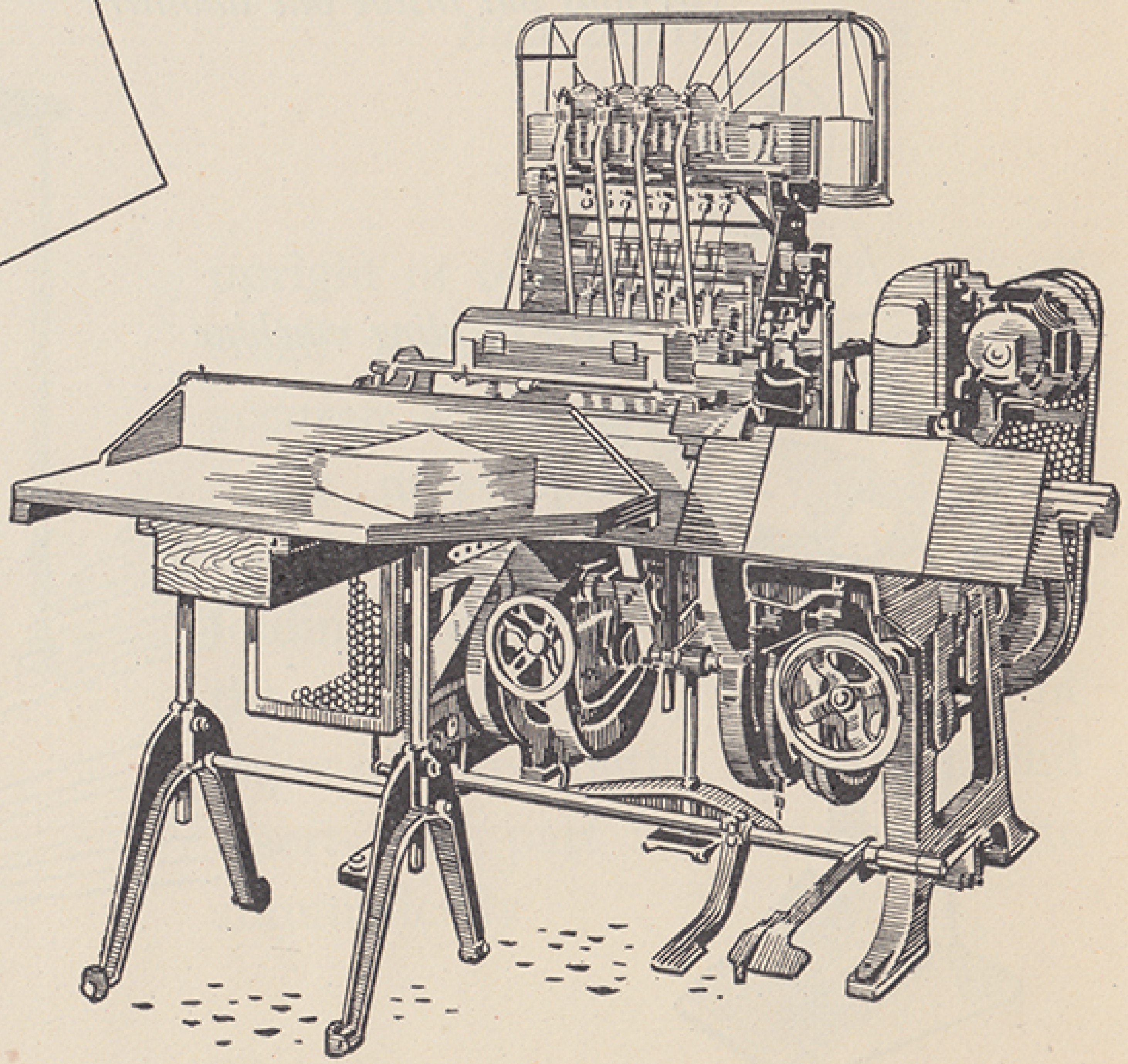
HAND STITCHING

Of course you can do this by hand with thread, cord, or even with ribbon, as is sometimes done for Christmas cards or programmes.

The simplest way is shown in a diagram here. The knot or bow can be at the middle or end of the stitch, as you like. For a knot at the middle, put your needle in at one point, out and in again at the centre leaving a small loop, and then out at a third point. Now cut off the thread, put the two loose ends through the loop in opposite directions, pull tight, and tie a reef knot or bow. You can use this stitch with sections of plain paper to make yourself sketch books or note books.



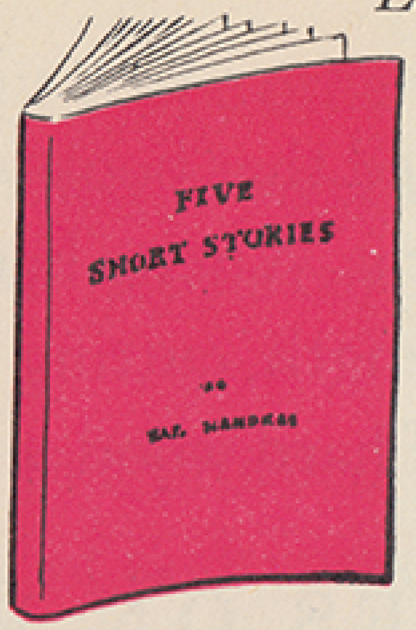
Book-sewing machine



SEWING BY MACHINE

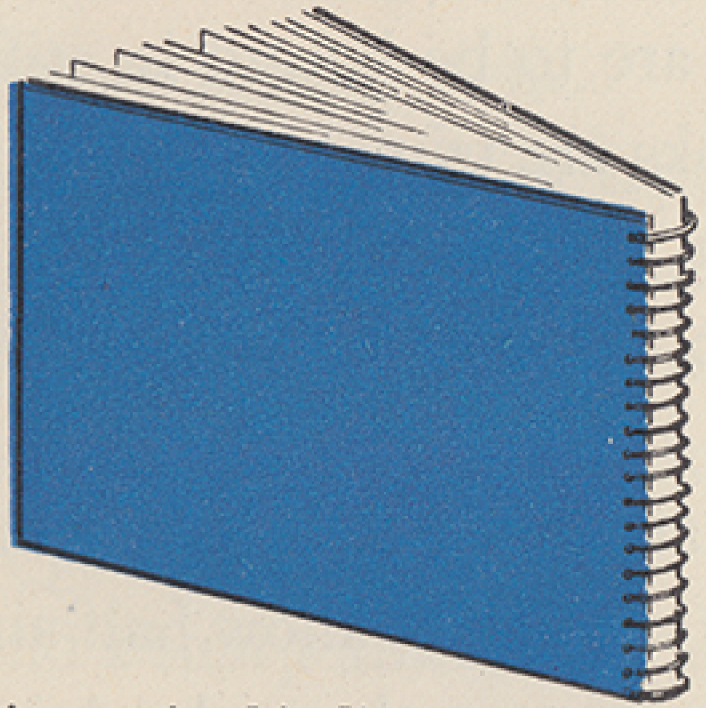
But supposing a much thicker book is being made. Then the sections must be arranged one after another. In this case they

Pamphlet



Limp cover

Stiff board case

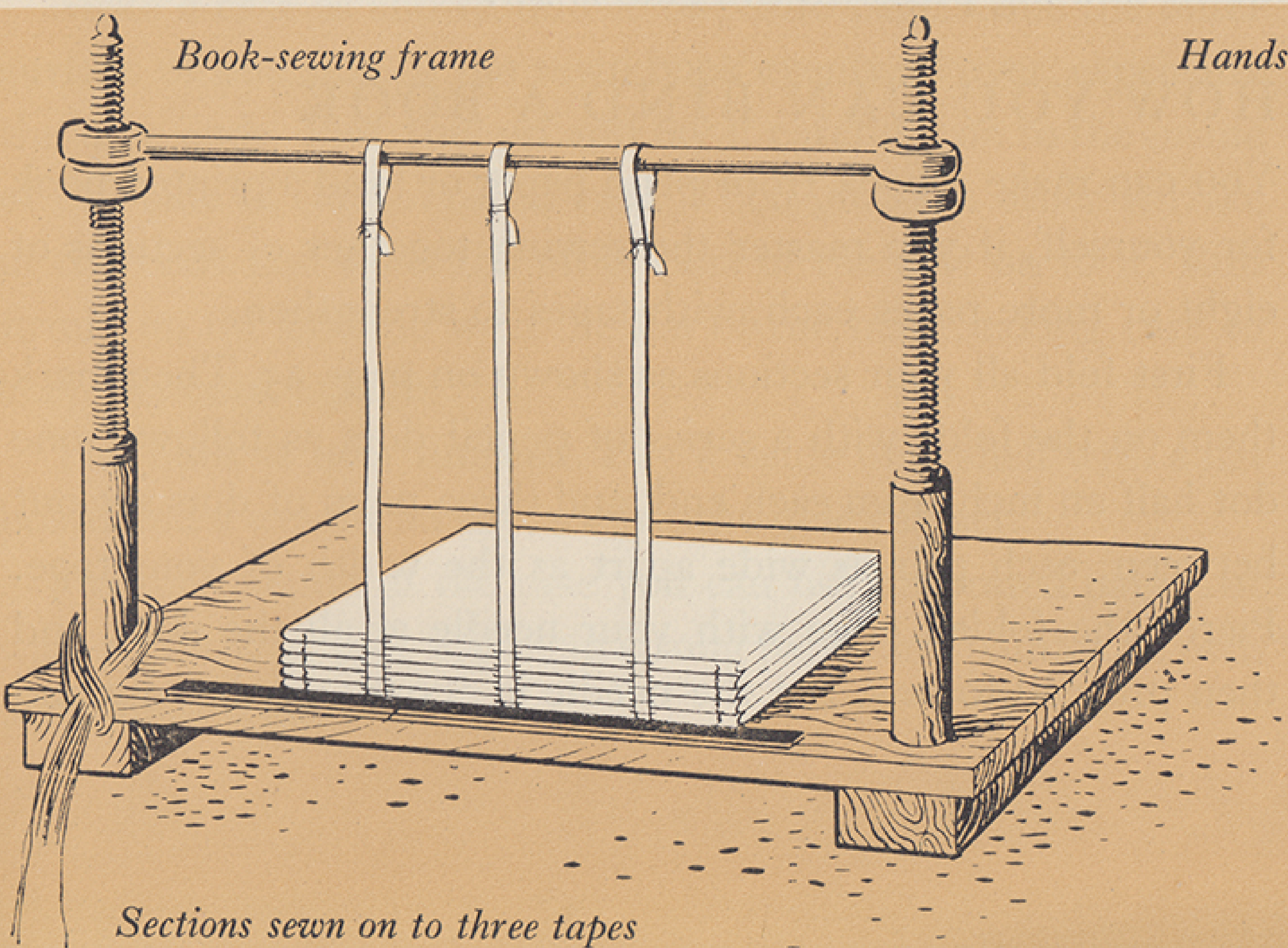


Spirax wire binding

are sewn together with one length of thread, and for strong work the sections are usually sewn to several tapes. The best work is sewn by hand on a frame like that shown below, but most books are sewn on a book-sewing machine, of which there is also a drawing opposite.

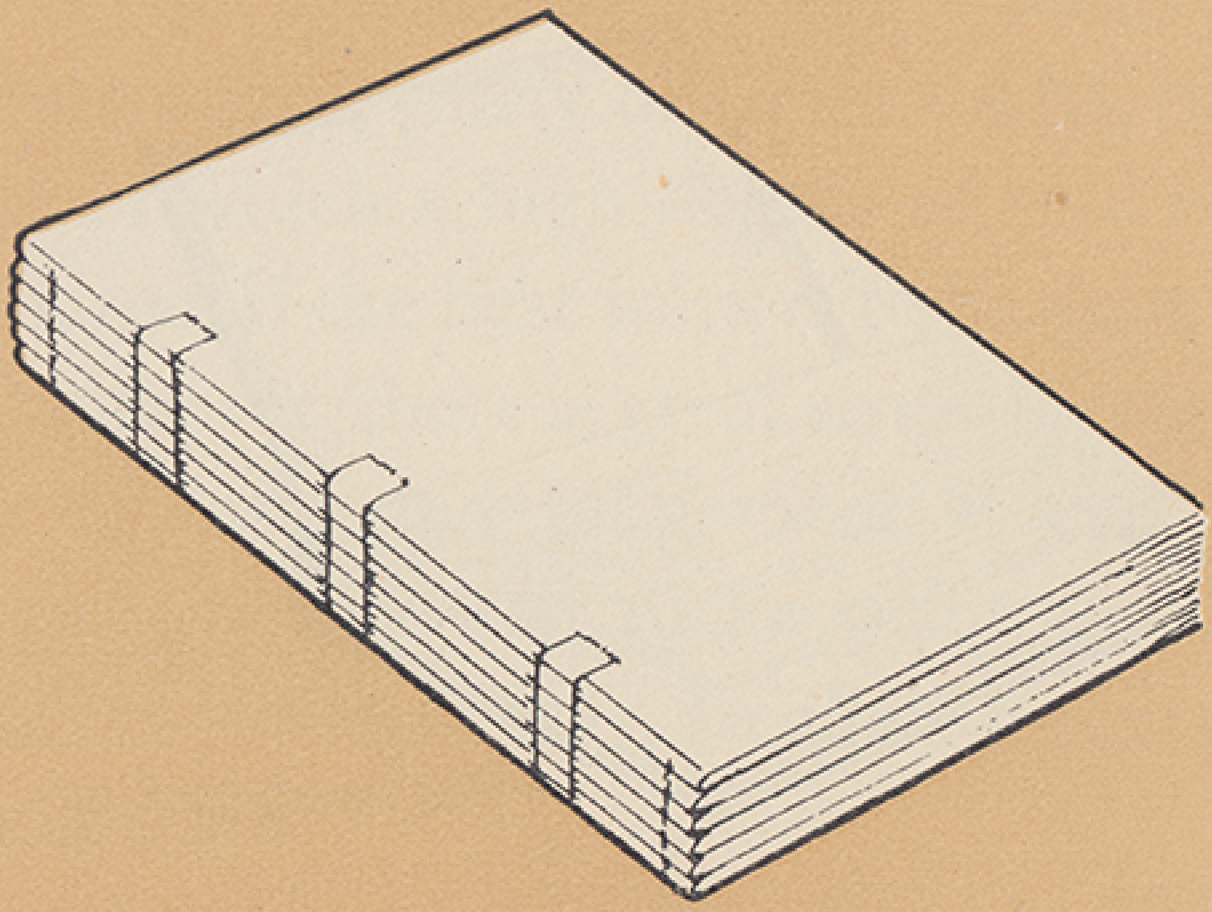
The final step is to put on a cover. If a limp cover is all that is needed, covers of stout paper, already printed, will be cut to exact size. Then a pile of sewn books is placed level with the edge of a table, and the whole surface of the backs is glued. Each book is then taken from the pile quickly while the glue is still sticky, laid on a cover in the right position, and the cover drawn over. Then the cover is rubbed on to the back of the book with a bone, or box-wood rubber. Some books are fastened with a spiral wire by a special machine.

Book-sewing frame



Sections sewn on to three tapes

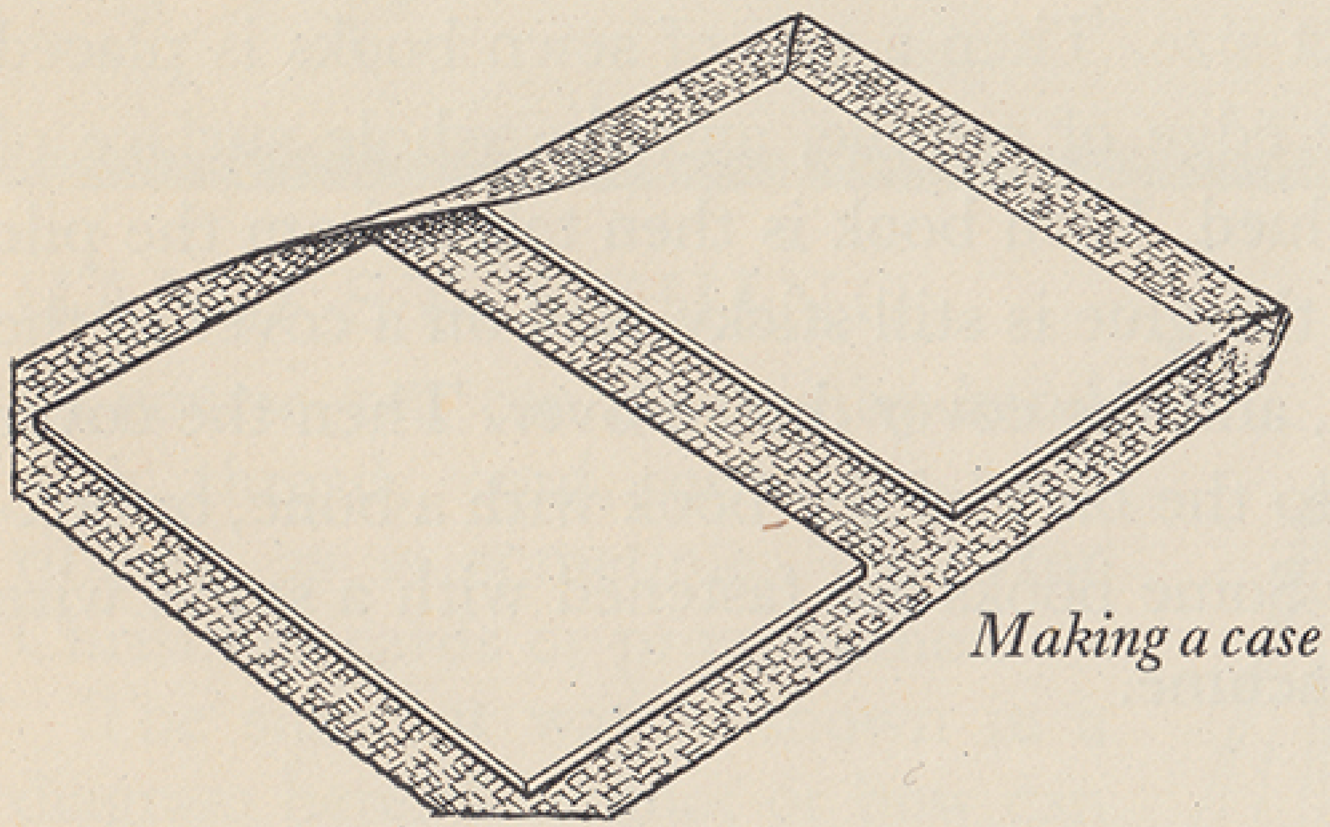
Handsewn book



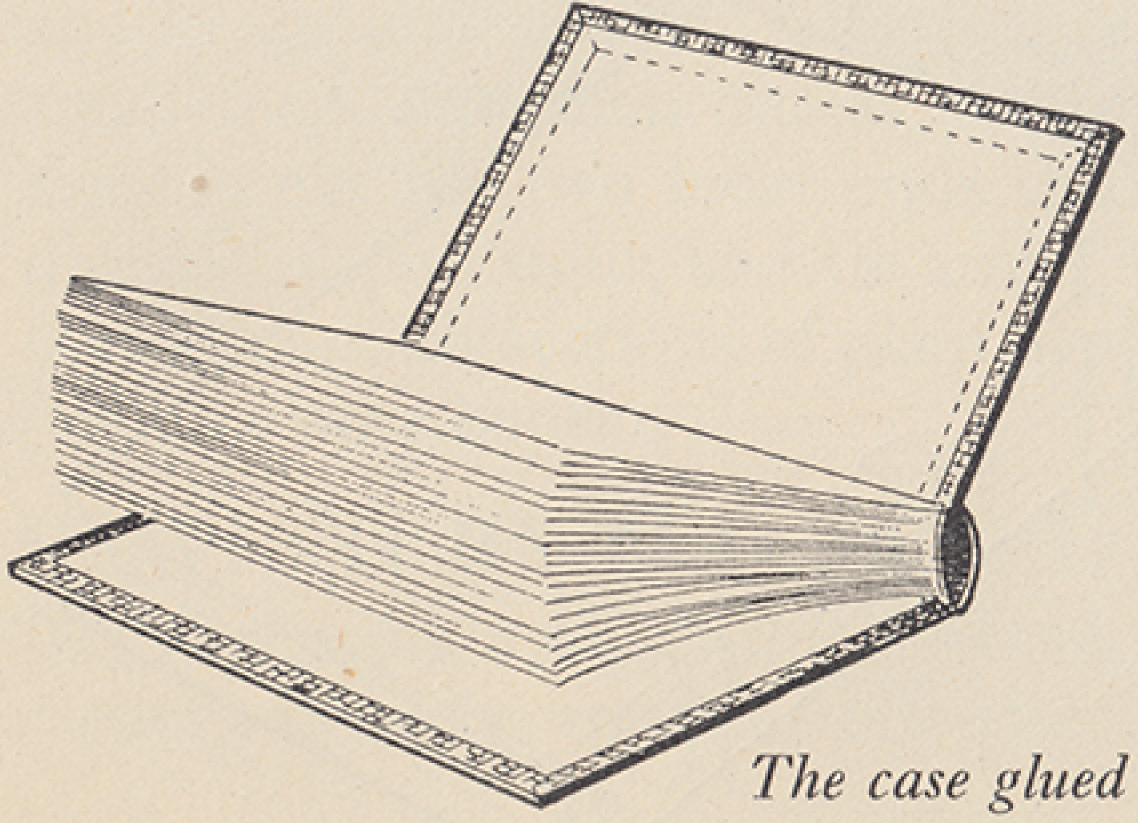
Tapes pasted down

CUTTING BOOKS, ETC. TO SIZE

When the books have either been stitched or glued into their covers, the edges are trimmed in a 'guillotine', which is a machine with a big knife. This knife is over the middle of an iron bed. It is so fitted that books or paper can be brought to an exact position under it. When a handle is pressed the knife comes down with great strength, cutting cleanly through the paper and down on to a stick of hard wood set in the middle of the iron bed.



Making a case



The case glued on

STIFF CASES ON BOOKS

If the books are to be bound in stiff covers of cloth or paper, the sewn books are trimmed to size in the guillotine before the case is put on. Cases are prepared by cutting pieces of cloth and cardboard to size, and building them up as shown in the picture.

The cards are just a little bigger than the book pages, and the cloth is large enough to allow half an inch all round for turning over. The books are then glued into the cases and screwed down in a big press till the glue is set.

HOW YOU CAN BIND A BOOK

You can make a book from plain paper or bind a printed book for yourself, if you master the sewing together of sections of eight or more pages each, with tapes to strengthen.

First fold all your sections as shown on page 25. Then mark them on the folds with a series of pencil dots as follows: one dot half an inch from each end, and three pairs of dots set out between, each pair as wide apart as the width of your tape. Pierce the folded edge with your needle at all the dots, and then proceed to sew. Put the needle in at one end dot, out and in again over each tape, and out at the other end dot. Then sew back along the next section. When you get back to the starting point, tie the loose end and your needle thread together, having first drawn the thread tight.

Do not cut off the thread but proceed with the third and succeeding sections. At the end of each succeeding section make the 'Kettle' stitch, as shown in drawing, to hold the sections together. At all stages keep your sewing tight.

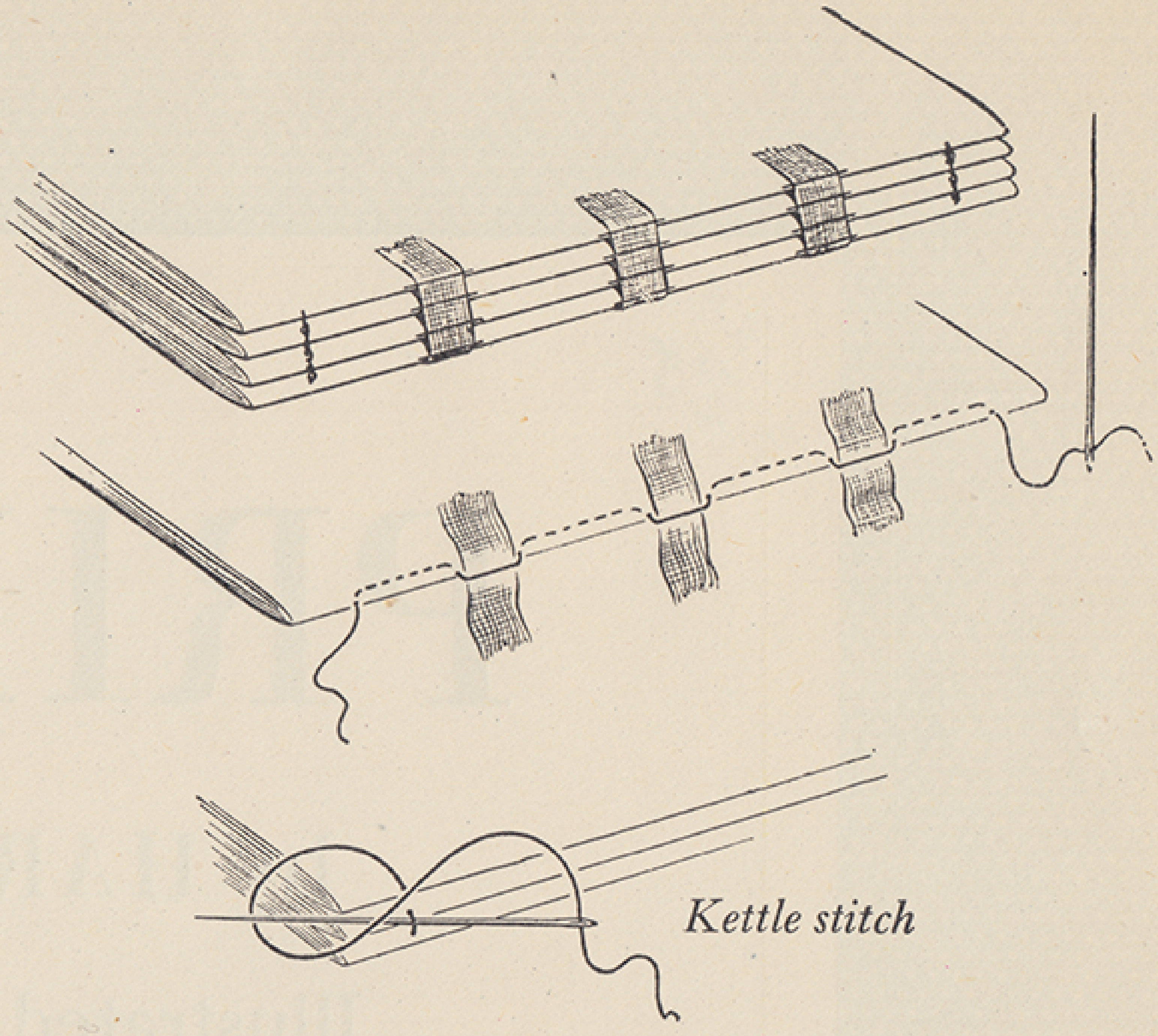
When all sections are sewn, glue the ends of tape down on to the book, drawing them tight. When the glued ends of tape are set, hold the back of the book firm between two boards and brush the backs of the sections with glue, working it well in. Then leave overnight under pressure to set.

Now, with a steel ruler and a sharp knife, trim all three open edges square and neat.

Make a case as shown on the opposite page. Glue the outer surface of one side of the sewn book evenly all over, especially the tape ends. Pick this up and lay it carefully on to the inside of one side of the prepared case. Then glue the other surface of the book and draw the other part of the case on to it. Rub firmly on the outside with the flat of the hand, taking care to keep the book square.

The book is now finished. Lay it aside on a shelf with a flat board and a weight on top, so that the glue can set.

For the outside of the case you can use decorated paper, or wall-paper scraps, or use plain strong paper and paint your own decoration on it.



IN CONCLUSION

This little book has given only the briefest outline of a few of the most-used processes. The word 'Printing', you see, covers a great many different crafts, in each of which a high degree of skill is required, if the best work is to be done.

Moreover, there is great scope for the use of taste and judgement at every stage, and this can make printing, if taken in the right way, an all-absorbing occupation.

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PRINTING

by HAROLD CURWEN

Illustrated by JACK BROUGH

PUFFIN PICTURE BOOK 70